PREDICTING WEIGHT LOSS IN POST SURGICAL LAPAROSCOPIC BANDING PATIENTS

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The present study was a retrospective chart review (*N*=128) that investigated the efficacy of profiles derived from the three factors of the Eating Inventory® test[*] (EI) – cognitive restraint, disinhibition, and hunger – to predict successful weight loss in post surgical laparoscopic banding patients at 6 and 9 months post surgery. Although the EI is commonly used in bariatric presurgical assessment, few studies have found consistent relationships between presurgical factor scores and subsequent weight loss in this population. Based on restraint theory, 7 profiles (high CR, super high CR, high D, super high D, high H, super high H, and null) were derived from the raw scores on the subscales of the EI and tested for weight loss predictive ability using direct logistic regression. Results were mixed with high CR, super high CR, and null profiles accurately predicting successful weight loss. Raw scores on the three factors (cognitive restraint, disinhibition, and hunger) were tested individually for predictive ability using direct logistic regression. Overall results indicated that the profile model accurately predicted more cases than the general factor model. This study significantly contributes to both the bariatric presurgical assessment literature and the restraint theory literature. Suggestions for future research are offered.

[*] Harcourt Assessment, Inc., http://harcourtassessment.com

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CHAPTER I

INTRODUCTION: OVERVIEW OF THE OBESITY EPIDEMIC

Obesity is increasingly prevalent in the United States with approximately 6 million severely obese adults (i.e., body mass index [BMI] $\geq$ 40 kg/m^2) and another ten million at significant health risks with BMIs greater than 35 kg/m^2 (American Society for Bariatric Surgery [ASBS], 2003; Flegal, Carroll, Ogden & Johnson, 2002). The Center for Disease Control (CDC) has established that morbid obesity greatly increases the prevalence of numerous chronic debilitating diseases when compared with normal weight individuals (Moore & Martin, 2004). For example, hypertension, coronary heart disease, type 2 diabetes, arthritis, dyslipidemia, sleep apnea, hypercholesterolemia, and asthma are commonly comorbid in obese individuals (ASBS, 2001). The US Surgeon General's Office (2002) referred to the current rates of obesity as a "public health epidemic," stating approximately 300,000 obesity-related deaths occur each year. The American Cancer Society (2003) reported that 90,000 cancer deaths per year are weight-related. Moreover, the estimated cost of obesity is approximately $117 billion, the largest proportions of the costs associated with the treatment of type 2 diabetes (Moore & Martin, 2004).

Along with the array of adverse physical consequences, obesity is also associated with harmful psychosocial ramifications and quality of life issues. Weight-related stigmatization is prevalent throughout the lifecycle and is evident not only in society's negative attitudes toward overweight individuals, but also in the attitudes of overweight individuals themselves. Many obese individuals intensely believe that they can attain a slender body if only they try hard enough. Thus, they support the notion that they are solely to blame for their weight and shape. These beliefs often lead to unrealistic goals and self-defeating reactions to setbacks (Brownell & O'Neil, 1993; Jeffery, & McGuire, 2001). Along with social stigma, obese individuals report reduced vitality and physical impairment, negatively impacting social and occupational roles (Wadden et al., 2001).

Billons of dollars have been funded for research in development and implementation of obesity treatment such as drugs and commercial weight loss programs (Henderson & Brownell, 2004). However, an extensive literature confirms that treatments that are often successful for mild to moderate obesity (e.g., low calorie diets) are ineffective for long-term weight loss in severely obese individuals (National Institute of Health, 1993; Rowe, Downey, Faust, & Horn, 2000; Stunkard, Stinnet, & Smoller, 1986). As a result, bariatric surgery is often medically necessary for patients with BMIs greater than 40 kg/m^2, as well as for patients with BMIs greater than 30 kg/m^2 in the presence of severe comorbidity (ASBS, 2003; Balsiger, Murr, Poggio, & Sarr, 2000; DiCosmo, Vuolo, Piccolomini, Maglio, & Carli, 2000; Jones, 2000).

The laparoscopic banding procedure is widely recognized as a safe and effective method of achieving weight loss for the critically obese patient. Thus, it is a viable alternative to open surgical techniques such as gastric bypass (ASBS, 2003; Dixon, & O'Brien, 2002a; Dukhno, Ovnat, & Levy, 2003). Bariatric surgery, in general, usually results in dramatic improvement in obesity-related comorbidities such as hypertension and type 2 diabetes (Dixon & O'Brien, 2002b). Laparoscopic banding offers additional advantages of shortened hospital stays, improved postoperative course, better cosmetic results, adjustability, earlier return to normal activities, and removal, if necessary (Dukhno et al., 2003).

Successful weight loss with the laparoscopic banding procedure depends largely on the patient's motivation and capacity to make life-long behavioral changes (Favretti, O'Brien, & Dixon, 2002; Gertler & Ramsey-Stewart, 1986). Accordingly, presurgical psychological screening of bariatric patients is advocated in order to assess general attitudes, personality traits, and behaviors believed to negatively affect long-term weight loss (Andrews, 1995). Of notable concern are ingrained eating behaviors that are thought to be intensified by traditional long-term dieting. For example, research indicates that traditional weight loss programs tend to encourage dietary restraint and have the potential to result in a diet/overeating cycle that results in "yo-yo" weight loss and weight gain (e.g., Bacon et al., 2002; Polivy & Herman, 1985). Specifically, many researchers have suggested that weight fluctuation results from the pattern of dietary restraint followed by disinhibition created by emotional distress such as anxiety and depression, alcohol consumption, and the perception of having overeaten (e.g., Lowe, 1993; Polivy, 1976; Polivy, Heatherton, & Herman, 1988; Ruderman, 1985; Ruderman,1986).

Virtually all individuals who present to bariatric clinics as candidates for bariatric surgery are life-long dieters and have experienced the perpetual weight gain-weight loss cycle (ASBS, 2003). Accordingly, along with other psychological tests within the standard battery for bariatric surgical candidates, it is critically important to assess eating behavior. Thus, measures such as the Eating Inventory® test[*] (EI, Stunkard & Messick, 1985) are often included in standard bariatric presurgical test batteries. The EI

[*] Harcourt Assessment, Inc., http://harcourtassessment.com/

assesses three dimensions of eating behavior: 1) cognitive restraint, 2) disinhibition, and 3) hunger. Scores on the three dimensions or factors help identify characteristics that may heavily contribute to individual eating behavior and thus, are thought to be useful in creating individual treatment interventions (Stunkard & Messick, 1985). However, predicting successful weight loss in laparoscopic banding patients, a highly heterogeneous population, has been inconsistent (Chau et al., 2005; DeMaria et al., 2005).

The literature regarding psychological profiles and variables that predict successful outcomes in bariatric surgery patients is conflicting. Some researchers contend that the bariatric surgical population has no more psychopathology than the normal population (e.g., Gertler & Ramsey-Stewart, 1986). Others hold that bariatric patients have remarkably more psychopathology such as mood disorders, anxiety disorders, and personality disorders than the normal population (e.g., Grana, Coolige, & Merwin, 1989). Still others hold that compared to their normal weight counterparts, there are significantly higher rates of depression and suicidality in obese women, but not in men (Carpenter, Hasin, Allison & Faith, 2000). Nevertheless, most researchers agree that bariatric patients commonly display general attitudes, personality traits, and behaviors, if not severe psychopathology, that are likely to sabotage weight loss after bariatric surgery (e.g., Andrews, 1995; Hsu et al., 1998; Macias & Vaz Leal, 2002). However, the search for specific variables that negatively affect long-term weight loss has not been entirely successful (Hsu et al., 1998; Poston et al., 1999). Further, weight loss is more variable after laparoscopic banding than after alternative procedures such as gastric bypass (Chau et al., 2005). Thus, it is even more difficult to accurately predict which laparoscopic banding patients will require presurgical and/or post surgical psychological intervention in order to ensure long-term successful weight loss.

Andrews (1995) contends that the inability to predict successful bariatric surgical outcomes lies in the types of assessment measures that are commonly used. Traditionally, bariatric surgical candidates have been evaluated utilizing gold standard measures. For example, the *Minnesota Multiphasic Personality Inventory*, 2nd Edition (MMPI-2) (Butcher & Megargee, 1989) is commonly used in presurgical evaluations. Recently, other assessment tools such as the *Millon Behavioral Medicine Diagnostic* (Millon, Antoni, Millon, Meagher, & Grossman, 2001) are being explored that may better identify issues, characteristics, concerns, and behaviors relevant to bariatric surgical patients (e.g., Begyn et al., 2005; Frensley et al., 2005). Given that coping styles, psychiatric conditions, and psychological states and traits are thought to affect an individual's ability to adhere to life-long behavior changes (e.g., Favretti, O'Brien, & Dixon, 2002; Gertler & Ramsey-Stewart, 1986) and thus affect post surgical outcome, it is intuitive that life-long eating behaviors would also be highly associated with surgical outcome.

The EI, which assesses three eating behavior factors (i.e., cognitive restraint, disinhibition, and hunger), is widely used as an assessment tool in weight loss treatment planning. The measure is grounded in Herman and Mack's (1975) seminal research on "restrained eating" (i.e., the tendency for individuals to control their food intake through conscious efforts) and subsequent studies (e.g., Polivy & Herman, 1976) that explored a paradoxical behavior called "counter regulation" or "disinhibition" where restraint is temporarily overridden in certain situations and environments.

Changes have been observed in EI scores during the course of obesity treatment (e.g., Clark, Marcus, Pera, & Niaura, 1994; Lang, Hauser, Buddeberg, & Klaghofer, 2002), but few studies have found consistent relationships between initial (i.e., pre-treatment) EI scores and subsequent weight loss (e.g., Karlsson et al., 1994; LaPorte & Stunkard, 1990). There is a notable absence of studies utilizing the EI to predict outcomes in bariatric patients although this measure is often used in presurgical assessment.

Many psychological assessment measures (e.g., MMPI-2® test* and Health Attribution Test) are considered to be more diagnostically meaningful when profiles or configurations of the single scale scores within the measure are interpreted as a whole rather than individually (Achterberg & Lawlis, 1990; Graham, 2000). The EI (Stunkard & Messick, 1985), with single scores on three factors, intuitively lends itself to this type of diagnostic utility. A question not yet explored is whether the three dimensions of eating behavior measured by the EI (i.e., cognitive restraint, disinhibition, and hunger) may be predictive of post surgical weight loss when considered as a whole (i.e., simultaneously or as a profile) rather than scores considered individually. The purpose of this study, then, is to examine the efficacy of eating behavior profiles derived from the three factors on the EI (cognitive restraint, disinhibition, and hunger) as a predictor of successful weight loss at 6 and 9 months post laparoscopic banding surgery.

*Pearson Assessments, http://www.pearsonassessments.com/tests/mmpi_2.htm

CHAPTER II

LITERATURE REVIEW

Obesity Defined

Simply defined, obesity results when caloric intake chronically exceeds energy expenditure resulting in excessive body fat gain (Cope, Fernandez, & Allison, 2004). However, obesity is a complex condition often defined in terms of social standards of appearance (e.g., Low et al., 2003), culture (e.g., Brandenburg, 2003), body mass (National Heart, Lung, and Blood Institute, 1998), standard weight charts (e.g., Metropolitan Life, 1983) and health (American Society for Bariatric Surgery, 2003).

Obesity is frequently defined as body weight that is at least 20% over the standard weight tables published by life insurance companies (Gatchel & Oordt, 2003). In 1942, Metropolitan Life Insurance Company conducted a study on longevity based on the heights, weights, and body frames (small, medium, large) of 4 million people insured with the company. It was discovered that the individuals who lived the longest were the ones who maintained their body weight at the average level for 25 year olds. These tables became widely used for determining recommended body weights. In 1942, the charts gave “ideal body weights,” but were revised in 1959 to delineate “desirable body weights.” They were again revised in 1983 and became “height and weight tables” (US National Library of Medicine, 2004). Although these height and weight charts are still in use, experts have criticized the validity of the weight tables for several reasons. For example, frame size was not consistently measured. Some individuals were weighed with shoes and/or clothing and others were not. Additionally, the tables do not consider percentage of body fat or distribution of body fat, which are thought to be important factors in longevity. Furthermore, individuals included in the Metropolitan Life study from which the tables were constructed were predominantly middle-class individuals (Brannon & Feist, 2000).

Because skeletal or frame size differs among individuals, definitions of obesity usually do not consider body weight alone. For example, muscle tissue and bone weigh more than fat tissue. Thus, an individual can be heavier, yet leaner, than what might be considered normal for his or her height and weight. This is often the case with athletes (Brannon & Feist, 2000). Based on the rationale that half of the body's total fat content is located in fat deposits directly beneath the skin, many health clubs define overweight and obesity in terms of subcutaneous fat folds. The skin is pinched in several places and then measured with a caliper. The measurements are then averaged to determine the percentage of body fat. While this method is quick and easy, it is also said to be highly unreliable and prone to errors of plus or minus 200% (Gatchel and Oordt, 2003).

The most precise method of measuring overweight is hydrostatic weighing. This method is based on the principle that different tissues have different levels of buoyancy (i.e., fat has more buoyancy than muscle and bone). Therefore, by comparing an individual's land weight to his or her weight underwater, percentage of body fat can be determined. Although hydrostatic weighing is highly accurate, it is also very costly, precluding use with the general population in most cases (Gatchel & Oordt, 2003; McDonald, 2004).

The most widely accepted method of measuring obesity is in terms of body mass index (BMI) (American Society of Bariatric Surgery, 2003; Bray, 1992; Gatchel & Oordt, 2003). BMI is defined as body weight in kilograms (kg) divided by height in meters squared (m^2) (i.e., BMI = kg/ m^2). According to the National Hearth, Lung, and Blood Institute (1998) and the World Health Organization (WHO,1998), BMI of 25 kg/m^2 to 29.9 kg/m^2 is considered overweight and BMI greater than 30 kg/ m^2 is considered obese. BMI of 30 kg/ m^2 to 34.9 kg/ m^2 is classified as class I obesity, 35 kg/ m^2 to 39.9 kg/ m^2 as class II obesity, and BMI of 40 kg/ m^2 or more is classified as class III or extreme obesity. The above delineations are grounded in epidemiological data showing increases in morbidity and mortality with BMIs greater than 25 kg/ m^2 (WHO, 1998).

Social Meaning of Obesity

Obesity is often defined in terms of social standards of appearance even though body weight defined in such terms often has little to do with health. For example, in centuries past, obesity may once have been the hallmark of prosperity, demonstrating wealth in the form of being able to afford an abundance of food. Before 1920, plumpness was considered attractive and extreme thinness was considered unattractive, presumably because of its association with disease and poverty (Beller, 1977). Over the decades standards changed, however, and thinness became highly desirable. Historian Roberta Seid (1989) defines the period after the turn of the 20th century as “the emergence of a thin preference which became a ‘prejudice’ in the 1950s, ‘myth’ in the ‘60s, ‘obsession’ in the ‘70s, and ‘religion’ in the ‘80s” (p. 525).

The preoccupation with thinness is aptly illustrated in two studies examining the changes in body weights of *Playboy* centerfolds and Miss America candidates over a 30-year period. Both studies revealed that the socially ideal body weight for women began a downward trend in the years1959 through 1988, while the average weight of

American women, based on actuarial tables, actually began to rise (Garner, Garfinkel, Schwartz & Thompson, 1980; Wiseman, Gray, Mosimann, & Ahrens, 1992). Paradoxically, the downward trend in “socially desirable weight” may have played a significant part in the current obesity epidemic in the form of “chronic dieting,” which tends to result in vast fluctuations in weight. Furthermore, Austin (1999) asserts that because little or no attention is given to diet in its cultural complexity, the medical and public health community gives scientific credibility to society’s obsession with dieting and is partly responsible for the promotion of a cultural climate that generates eating disorders and obesity.

The pressure to be thin in our culture is intense and is endlessly prescribed through television, billboards, magazines, and self-help books (e.g., Baird & Grieve, 2006; Derenne & Beresin, 2006; Snow & Harris, 1986). Further, there are seemingly countless diet-aid products and commercial weight loss programs paraded before the general public. Thus, the public is inundated with entreaties to diet (Strauss, Doyle, & Kreipe, 1994). Children internalize these messages at an early age, although perhaps not consciously (Low et al., 2003), and soon conclude that being overweight is highly undesirable (Brownell & O’Neil, 1993; Tiggemann, Gardiner, & Slater, 2000). For example, Richardson, Goodman, Hastorf, and Dornsbursch (1961) found that children assigned negative attributes such as “lazy,” “ugly” and “stupid” more often to pictures of obese individuals than to pictures of thin muscular individuals. The same was true when pictures of people with physical handicaps and facial disfigurations were included. Negative attitudes and stigmatization regarding obesity continue into adolescence when overweight adolescents are commonly teased by their peers. Hurtful weight-related comments often come from family members as well (Neumark-Sztainer & Haines, 2004). Not surprisingly, weight teasing is thought to be associated with disordered eating behaviors that place overweight adolescents at risk for even greater weight gain (Neumark-Sztainer, Falkner et al., 2002; Neumark-Sztainer, Story, & Faibisch, 1998;). Attitudes regarding obesity flourish in adulthood as well (Crandall, 1994; Crossrow, Jeffery, & McGuire, 2001).This appears to be particularly the case for women (Chen & Brown, 2005; Hebl & Turchin, 2005; Rothblum, 1992). Feminist scholars have argued that obesity, especially in women, is seen as a sign of “weak will, sloth, and animalistic appetite” (Austin, 1999).

Smuts (1992) asserts, “Except in a few traditional arts such as grand opera and sumo wrestling, fatness has become a profound handicap in all areas of social competition” (p.527). Indeed research bears this out with perhaps the most documented weight-based discrimination being in employment (e.g., Bellizzi & Hasty, 1998; Hebl & Kleck, 2002; Polinko & Popovich, 2001). Studies indicate that overweight applicants are less likely to be hired (e.g., Ding & Stillman, 2005) and once hired are likely to earn less money than their normal weight counterparts (e.g., Maranto & Stenolen, 2000). Personality traits are often rated more negatively in overweight individuals and these individuals are more apt to be perceived as having fewer skills than their normal weight counterparts (Crocker, Cornwell, & Major, 1993). Furthermore, obese persons are frequently disciplined more harshly, viewed as less effective managers, and are considered less fit for challenging sales territories (Bellizzi & Hasty, 1998; Decker, 1987; see Roehling, 1999 for review).

Studies also indicate that obese individuals are viewed as less sexually desirable (Chen & Brown, 2005; Harris, 1990) and are judged to be less likely to be married than their normal weight peers (Wadden et al., 2001). Weight-based discrimination is also found to be a factor in educational opportunities (Romero & Marini, 2006) as well as in healthcare (Johnson, 2002).

Surprisingly, many physicians and other health care professionals often assume that all people are meant to be thin and could accomplish this if they just ate less and exercised more. Thus, when patients are advised to lose weight and they fail to do so, health care professionals often describe them as lazy and lacking in motivation. Researchers account for these findings by positing that health care professionals are exposed to the same “antifat” messages as the general population. Thus, they have developed the same prejudices (Johnson, 2002; Najman, Klein, & Munro, 1982). Although counterintuitive, studies indicate that many mental health professionals also hold stereotypical beliefs and display negative attitudes toward obese individuals (Agell & Rothblum, 1991; Hassel, Amici, Thurston, & Gorsuch, 2001; Kaminsky & Gadaleta, 2002; Young & Powell, 1985). Further, many in the mental health care field assume that obese individuals have significantly more psychological problems and issues than their normal weight counterparts (Hassel et al. 2001). However, research has not given complete credence to this assumption.

Psychological Factors in Obesity

A number of researchers have found a high incidence of psychopathology in individuals with morbid obesity (Black, Goldstein, & Mason, 1992; Hutzler, Keen, Molinari, & Carey, 1981). However, with the exception of binge eating disorders (e.g., Adami, Gandolfo, Bauer, & Scopinaro, 1995; Kalarchian, Wilson, Brolin, & Bradley, 1998; Picot, & Lilenfeld, 2003; Wadden & Stunkard, 1985), the majority of studies have failed to unequivocally uncover greater degrees of psychopathology in obese individuals than in their normal weight counterparts (e.g., Andrews, 1995; Gertler, & Ramsey-Stewart, 1986; Wadden et al., 2001). Thus, identification of specific psychological variables as outcome predictors in weight loss interventions has been elusive (e.g., DiGregorio & Moorehead, 1994; Dixon & O'Brien, 2002a; Larsen et al., 2004; Vallis et al., 2001). As noted above, however, binge eating is the exception and is associated with poor outcomes of bariatric surgery (Ayad, 2004; Hsu et al., 1998; Macias & Vaz Leal, 2003; Saunders, 1999).

Morbid obesity is primarily a medical disorder that it is often exacerbated by secondary psychological states such as anxiety and depression and further complicated by maladaptive coping strategies and beliefs (Wadden et al., 2001). Multiple studies have documented a wide gamut of psychological consequences of obesity that range from lowered self-esteem and anxiety due to strong belief in self-culpability (Friedman et al., 2005; Wang, Brownell, & Wadden, 2004) to serious psychopathology (Greenberg, Perna, Kaplan, & Sullivan, 2005; Black, Goldstein, & Mason, 1992; Hutzler, Keen, Molinari, & Carey, 1981). Accordingly, morbidly obese bariatric surgical patients appear to be a heterogeneous group with many subtypes of pathological personality traits (Macias & Vaz Leal, 2002), mood disorders (Black, Goldstein, & Mason, 1992; Wadden et al., 2001), and eating disorders, most notably binge eating (Hsu et al., 1998).

The *Diagnostic and Statistical Manual of Mental Disorders,* 4th edition, text revision (*DSM-IV-TR*; American Psychiatric Association, 2000) delineates binge disorder as recurrent episodes of consuming objectively large amounts of food in a short period of time. The episode is generally accompanied by a sense of loss of control, which is followed by serious concerns about the long-term effect on weight and body shape. Binge episodes differ from the eating patterns of bulimia nervosa in that the binges are typically not followed by inappropriate compensatory behaviors (e.g., self-induced vomiting and misuse of laxatives) as is the case in classic bulimia nervosa. Obesity studies indicate that binge eating is related to higher BMIs and greater weight fluctuation due to chronic dieting. Further, it is not surprising that binge eaters have been shown to have higher disinhibition scores on the Eating Inventory® test* (EI) than their obese, but non-binging, counterparts (Adami, Gandolfo, Bauer, & Scopinaro, 1995; Kalarchian, Wilson, Brolin, & Bradley, 1998).

Due to the deleterious effects of post surgical binge eating in bariatric patients, it is important to presurgically identify and treat this eating pattern. Regardless of the type of bariatric surgery (e.g., laparoscopic banding, gastric bypass), post surgical eating is necessarily characterized by dietary restraint, restriction of food choices, and changes in how food is eaten such as limits on quantity of food ingested and extensive chewing before swallowing (deZwaan, 2005). However, eating behavior is particularly critical for post surgical success in laparoscopic banding patients. For these patients, any attempts to maintain old eating habits (e.g., overeating or binging) usually cause post surgical complications such as vomiting and can cause obstruction, band slippage, and prolapsed stomach through the band, which may lead to the necessity of the band being

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removed altogether. Surgeons report that problems adapting to new eating behaviors are associated with poor post surgical outcome in all types of bariatric surgery and are the most common cause for removal of an adjustable gastric band (Hotter et al., 2003; Martin, 2004a).

Theoretical Prospectives

Conceptualizations of the cause of obesity have changed since the 1950s when Freudian concepts dominated psychology and psychiatry. During this era it was widely held that obesity reflected an underlying personality disturbance causing conflicts that were acted out in excessive eating (Bellar, 1977). In the 1960s and 1970s, obesity began to be conceptualized as maladaptive eating patterns (e.g., Glass et al., 1969; Jeffrey & Christensen, 1975; Nisbett, 1968; Schachter, 1968) while research in the 1980s and 1990s focused on biological, genetic, and metabolic factors (e.g., Faith, Rha, Neal, & Allison, 1999; Stunkard, Sorensen et al., 1986).

A number of genes have been explored for eating and energy intake as well as energy expenditure and fat accumulation (Rankinen et al., 2002). Although progress has been made, there is very little evidence for specific genes associated with common forms of obesity. However, there are, no doubt, a number of genes that contribute to the etiology of obesity. Further, those genes may be highly dependent on their environment making obesity a highly complex phenotype (Cope, Fernandez, & Allison, 2004). Most researchers conclude that both genes and environmental factors such as culture and socially-mediated food intake along with more sedentary lifestyles are involved in the obesity epidemic (Marti, Moreno-Aliaga, Hebebrand, & Martinez, 2004).

The “hunger-obesity paradox” hypothesizes that obesity could be mediated by socioeconomic status. This controversial notion suggests that food choices and physiological adaptations to food insufficiencies (i.e., periodic food shortages) resulting from low income may cause increased body fat (Dietz, 1995; Olson, 1999). Thus, the paradox of an increased prevalence of simultaneous hunger and obesity in extremely low income populations is created. Dietz (1995) posited that this paradox may be explained by the increased fat content of low cost food eaten when the family lacks money. Olson (1999) expanded on this concept and suggested that the mechanism that connects hunger and obesity may be related to binge-like eating during times when food is plentiful. Further, this phenomenon was found mostly in females for which the following explanation was posited. When food supplies are low, mothers often forego eating so that their children have more food, which leads to overeating when money for enough food for the whole family is available. Thus, a “feast or famine” effect is created. Accordingly, this may result in an emotional relationship with food that puts certain individuals at risk for obesity regardless of subsequent positive changes in their socio-economic status. Although conceivable, the “hunger-obesity paradox” does not explain obesity in families where there have always been adequate funds for quality food choices. Nevertheless, it does illustrate the possibility of a deeply ingrained eating pattern that may affect many individuals throughout life.

Obesity undoubtedly has many causes that include innate as well as learned or acquired differences in metabolism. Just as there are multiple definitions of obesity, there are also multiple models that attempt to explain why some individuals are obese and others are not. The most widely researched models of obesity include the internal-external theory (Schachter, 1968; Schachter 1971), set point model (Nisbett, 1972), the positive incentive model (see Pinel, 2003, for review), the restraint theory (Herman & Mack, 1975; Polivy, 1976), and the boundary model (Herman & Polivy, 1983).

Schachter's internal-external model was the most widely held account of the differences in eating patterns in obese and normal weight individuals in the 1960s and early 1970s (see Ruderman, 1986, for review). Schachter held that eating behavior in normal weight individuals is controlled by internal physiological cues (e.g., gastric contractions) where the eating behavior in obese individuals is controlled by external cues (e.g., smell and taste of foods and time of day). Schachter's internal-external theory later expanded to include the proposition that obese individuals are more responsive to environmental (external) cues in general than are normal weight individuals. Thus, obese individuals are "stimulus bound." However, it was posited that this is true only if the environmental cues are "salient and compelling." Schachter (1971) stated, "It may be useful to more generally characterize the obese as stimulus bound….any stimulus above a given intensity is more likely to evoke an appropriate response from an obese than from a normal subject" (p. 138).

Schachter's internal-external theory generated enormous amounts of research that resulted in conflicting findings (e.g., Schachter 1971; Nisbett & Storms, 1974). A number of difficulties with these studies have been cited. One such difficulty was in finding good examples and definitions of external responsiveness pertaining to "non-food" environmental cues. As stated earlier, Schachter (1971) proposed that obese individuals would be more susceptible to any stimulus as long as it was salient and compelling. Accordingly, many studies utilized stimuli that had nothing to do with food, such as threat of electrical shock, audio tape recordings, and visual slides (e.g., Pliner, Meyer, & Blankstein, 1974). However, it was not clearly established a priori in such studies how obese individuals might need to differ from normal weight individuals in their responses to non-food stimuli in order to support Schachter's all-inclusive theory (Ruderman, 1986).

Ruderman (1986) described another difficulty or confound that perplexed researchers regarding Schachter's internal-external theory. Categorizing cues as internal or external was problematic. For example, "palatability" (i.e., pleasant to taste) was originally conceptualized as an external cue. Seemingly, support for Schachter's theory was confirmed by studies in which obese individuals' food consumption varied as a function of palatability as opposed to the variability in normal weight individuals. Later, however, researchers posited that appealing tastes or palatability is mediated by individual preference and not completely dependent upon the properties of the food itself. Thus, it was suggested that palatability can not be classified distinctly as either an internal or an external cue. Accordingly, it is considered questionable whether the differences found in palatability studies lend support to Schachter's theory.

At the peak of Schachter's theory in the early 1970s, Nisbett (1972) proposed the set point theory in which each person has a homeostatically defended ideal weight or "set point" that is individually determined. Further, obese individuals' set points are higher than normal weight individuals' set points due to a larger proportion of fat cells in obese individuals. The set point theory posits that when fat cells rise above or fall below a certain level, physiological mechanisms are activated resulting in a return to set point. Thus, when calories are drastically cut, the metabolic rate slows to require fewer calories making the body conserve energy expenditures. When this condition is extended, the slowed metabolism manifests in listlessness, apathy, hunger, and preoccupation with food (Brannon & Feist, 2000). Further, Nisbett (1972) hypothesized that many obese individuals try to suppress their weight below their biologically determined set point which results in their bodies reacting as if they were underweight and starving. Consequently, these individuals become more taste-responsive, more emotional, and less active than their normal weight counterparts.

Two distinguished studies that seem consistent with the set point theory are seminal studies in experimental starvation conducted with conscientious objectors during the Korean war and later studies in experimental overeating (Keys, Brozek, Henschel, Mickelsen, & Taylor, 1950, cited in Kalm & Semba, 2005; Sims, 1974). In these studies, the participants had difficulty in both losing weight past the initial rapid weight loss and gaining weight beyond the initial weight gain respectively. After the participants in the Keys et al. study had been re-fed and most had regained their lost weight, they were still preoccupied with food and did not regain their pretest optimism and cheerfulness. Interestingly, the only two participants in the Sims' (1974) overeating study who were not able to return to their original weight had a family history of obesity, although both were initially normal weight and had never before had a weight issue.

Nisbett's (1972) assumptions regarding the relationship between number of fat cells, set point, and body weight have not been supported, but the basic concept of a homeostatically defended body weight remains viable. However, initial advocates of the set point model (e.g., Polivy & Herman, 1983) now concede that variations from set point are possible. For instance, it is possible to become obese by simply overeating and it is also possible to maintain weight loss lower than set point through conscious efforts to restrain eating (i.e., cognitive restraint).

The inability to explain the variations in the set point model led to the formulation of the positive incentive model which holds that positive reinforcers of eating (e.g., personal pleasure, social context, and biological factors) significantly affect weight maintenance (Pinel, 2003). Personal pleasure factors include the taste of food and how pleasurable the eating experience is at a particular time. Having a variety of foods from which to choose also influences weight. When there are a wide variety of accessible foods, there are always new tastes available and in that situation, many people never become satiated for all the available foods. Consequently, they overeat in this environment. For example, all-you-can-eat buffets and super-size offers of fast food restaurants often entice individuals to eat past satiety even when they are not hungry (Hockenbury & Hockenbury, 2003). The social context of eating also considers such factors as cultural and ethnic background and whether there are other people present who are eating. Biological factors are also considered in this model such as time elapsed since eating and blood glucose levels. Thus, the positive incentive model holds that rather than having a set point that controls food intake, people learn to regulate their eating. Therefore, the positive incentive model predicts a variety of body weights depending on individual experience with food, which is influenced by biology, culture, palatability, and the availability of a variety of food (Pinel, 2003).

Although Nisbett's (1972) set point theory proved difficult to test, it drew attention to the role of dieting in determining eating patterns and weight regulation. This, in turn, spawned other prominent theories that produced copious research. For example, Herman and Mack (1975) developed the concept of restraint which posits that chronic dieters (i.e., restrained eaters) consciously and deliberately regulate their caloric intake as a method to control their weight. On the other end of the continuum are unrestrained eaters who eat freely without consciously restricting their food consumption. According to Ruderman (1986) there are two basic hypotheses of the restraint theory:

> 1) disinhibition hypothesis and 2) obese characteristics hypothesis. The disinhibition hypothesis proposes that self-control of restrained eaters may be temporarily released or interfered with by certain events called “disinhibitors.” (p.248)

As a result, the restrained eater’s desire for food prevails and the restraint is temporarily lifted. The obese characteristics hypothesis posits that “obese individuals are expected to show systematically higher levels of restraint than are normal weight people” (p. 249). Herman and Polivy (1983) took the restraint hypothesis a step further and proposed a boundary model where food consumption is maintained within certain boundaries that are regulated by “biological pressures.” The minimum boundary is purportedly regulated by the discomfort of hunger and the maximum boundary is regulated by the feeling of satiety. Any area between the two boundaries operates as the “biological indifference zone.” This area of biological indifference is hypothesized to be wider in dieters than in non-dieters because dieters require more food deprivation to report hunger and greater food consumption to perceive satiation. Further, dieters have another area located within the area of biological indifference that marks “maximum desired consumption.” Supposedly, once a restrained eater breaches the “diet boundary,” he or she will continue to eat until the satiety boundary is also breached. Notably missing in the boundary model is any mention of obesity even though the boundary model was an expansion of the restraint theory for which “obesity characteristics” encompassed one of the two basic hypotheses (Ruderman, 1986).

Many years of research seems to confirm that for some obese individuals, not eating in the presence of food is a source of anxiety that precipitates the urge to eat both in situations when perceived hunger is present and when it is not (e.g., Pitre & Nicki, 1992). The restrained eater then attempts to bring eating behavior under conscious control (i.e., cognitive restraint) rather than physiological control (Reeve, 1997). The concept of restrained (and unrestrained) eating was first proposed by Herman and Mack (1975). Subsequent evidence continues to mount and theories continue to be debated regarding the relationship among dietary restraint, disinhibition, weight fluctuation, and deleterious effects on health (e.g., Carmody, Brunner, & St. Jeor, 1995; Lowe, 1993; De Castro, 1995). For example, studies have shown that disinhibition is significantly greater in obese individuals than in non-obese individuals, but only in those who have a history of weight cycling (e.g., Carmody et al., 1995). High cognitive restraint has also been shown to be related to weight cycling (e.g., Lowe & Timko, 2004). Given that virtually all bariatric surgical patients are life-long dieters resulting in years of weight cycling (ASBS, 2003), it is intuitive that both high cognitive restraint and disinhibition would be prominent factors in this population.

Three types of triggers, or disinhibitors, are thought to provoke overeating in restrained eaters, but not unrestrained eaters: 1) preload (i.e., having consumed a high-calorie food), 2) dysphoric mood, and 3) alcohol consumption (Herman & Mack, 1975; Herman & Polivy, 1975; Polivy, Herman, Younger, & Erskine, 1979). Research supports the notion that highly restrained eaters or chronic dieters become more susceptible to release of cognitive restraint, or disinhibition, under certain conditions, which in turn, contributes to weight cycling. This is thought to occur, in part, because highly restrained eaters tend to hold an all-or-nothing view of dieting or what Polivy and Herman (1983) referred to as the "what-the-hell effect" (Rotenberg & Flood, 2000). Thus, after having "blown it [diet] for the day," restrained eaters continue to eat past the point of satiety (Ruderman, 1986).

Over the years a profuse amount of research has spawned from Herman and Mack's (1975) seminal research on the disinhibition effect of preloads or perceived preloads on highly restrained eaters. Possible moderating factors have been explored as well. For example, attribution styles such as learned helplessness have been associated with higher preloading disinhibition effects than in those with other attribution styles (e.g., Rotenberg & Flood, 2000). Interestingly, diet-related television commercials have also been shown to disinhibit highly restrained eaters, which may be associated with ego threat (Strauss, Doyle, & Kreipe, 1994). However, stress and negative mood continue to be cited as the most frequent precipitators of binge eating (e.g., Denious, 2004; Dodd, 2004; Greeno & Wing, 1994; Mazzeo, Saunders, & Mitchell, 2005; Pawlow, O'Neil, & Malcolm, 2003; Polivy & Herman, 1976; Vanderlinden et al., 2004). Emotional eating in massively obese individuals is relatively common and appears to have an affect-reducing effect in situations that involve negative emotions such as anger, loneliness, boredom, and depression (Ganley, 1989). Alcohol is also thought to be a disinhibitor of restrained eating behavior, but has generated a much smaller number of studies (e.g., Polivy & Herman, 1976; Wardle & Beales, 1987) and results have been conflicting (Ouwens, van Strien, & van der Staak, 2003).

In their seminal work, Herman and Polivy (1975) did most of their studies with participants of normal weight. However, at about the same time Meyer and Pudel (1977) were conducting similar studies with both obese and normal weight individuals resulting in the formulation of the concept of latent obesity. It was observed that there were differences in the way obese individuals and non-obese individuals eat a meal. Normal weight individuals gradually slowed their consumption rate as they ate while obese individuals did not. However, in subsequent research it was discovered that some non-obese individuals also failed to gradually slow their rate of consumption while eating a meal. Meyer and Pudel posited that these persons may be latent obese or biologically programmed to be obese, but were able to maintain normal weight by consciously restricting food intake. This research culminated in the development of the Latent Obesity Questionnaire (Meyer & Pudel, 1977), a seldom used instrument designed to assess the concept of latent obesity. The scale had theoretical problems in that it did not lend itself to addressing restrained obese individuals. Similarly, the Restraint Scale (Herman & Polivy, 1980) was also not successful in assessing the eating behavior of obese individuals. Although the EI was based on the concepts of restraint theory and latent obesity, it was developed to address the problems of both the Restraint Scale and the Latent Obesity Questionnaire (Stunkard & Messick, 1988).

The initial version of the EI (Stunkard & Messick, 1985) was developed by factor analyzing the responses of 220 participants on an initial pool of 67 items taken from three sources: 1) Herman and Polivy's (1980) Restraint Scale, 2) Meyer and Pudel's (1977) Latent Obesity Questionnaire, and 3) Stunkard's clinical experience. Three factors were revealed: 1) cognitive control of eating behavior, 2) lability in weight and behavior, and 3) hunger and behavior. These factors were used as guides for item revisions and the development of new items. The final version was factor analyzed using the responses of 98 participants. The three factors were interpreted as follows: Factor I, cognitive control of eating behavior (i.e., cognitive restraint), Factor II, disinhibition, and Factor III, susceptibility to hunger (Stunkard & Messick, 1988). (For discussion of the psychometric properties of the EI, see Psychometric Properties section in Chapter III.)

The EI has been used successfully in predicting weight gain following smoking cessation, evaluating the efficacy of interventions for obesity, and in accounting for weight changes among individuals with depression (Stunkard & Messick, 1985). Relatively recent research also lends support to the notion that cognitive restraint and disinhibition assessed by the EI are significantly associated with such things as BMI and body weight (Bellisle et al., 2004). However, in a recent pilot study of post surgical laparoscopic banding patients, the relationship between BMI change and EI subscale changes were not significant (Kaiser et al., 2004). Nevertheless, it is intuitive that presurgical assessment of eating attitudes and behaviors are an essential part of assessing bariatric surgical candidates (Foster et al., 1998; LeMont, Moorehead, Parish, Reto, & Ritz, 2004) and is indeed included in most standard presurgical psychological batteries. However, what is unclear is whether presurgical eating behaviors as measured by the EI (i.e., cognitive restraint, disinhibition, and hunger) accurately predict successful post surgical weight loss and are thus useful in designing presurgical and post surgical interventions for bariatric patients.

Nonsurgical Treatment of Obesity

There are a variety of treatment methods for obesity. The most frequently used treatment approach for overweight and obese individuals is self-directed weight loss programs that are encountered through a myriad of sources such as books, popular magazines, friends, family members, and the Internet. Many of these sources recommend caloric intake that ranges from total fasts to very low calorie diets. Although low and very low calorie diets are thought to be appropriate for some, fasting is associated with significant health risks (Melanson & Dwyer, 2002).

Many popular diet books promote “the best approach” to weight loss according to a particular theory. For example, *Dr. Atkins’ New Diet Revolution* (Atkins, 2002) advocates restricting carbohydrates and is a popular approach possibly because low carbohydrate diets often allow dieters to eat high fat foods, which many individuals find appealing. However, this approach may be potentially dangerous due to increases in serum cholesterol (Brannon & Feist, 2000). High carbohydrate/low fat diets also have their advocates and are effective for many individuals (Ornish, 1990). For some, however, these diets leave the dieter with the feelings of constantly being deprived of preferred foods, which in turn leads to cheating (Brannon & Feist, 2000). The cornerstone of self-directed weight loss programs and the most recommended by nutritionists and dietitians is the balanced deficit diet, which is low in fat, moderate in protein, and high in complex carbohydrates (Sarwer, Foster, & Wadden, 2004).

In their book *Breaking the Diet Habit,* Polivy and Herman (1983) advocated what was then a revolutionary concept even to some in the research field and certainly to the lay public. Along with the expected admonitions regarding the possible health dangers of miracle cures and diet pills, the authors made a case that dieting actually causes overweight by the tendency of dieters to adopt “external criteria for eating.” Further, the authors stated that due to the attempt to tamper with the body’s natural tendency to adapt and respond to environmental cues, deleterious consequences could result whether or not the dieter lost weight. “The body, to protect itself, becomes anabolic (fat storage prone), even if the dieter has not lost a significant amount of weight” (p. 166).

Along with the plethora of advice about diets, both pro and con, there are also numerous commercial programs such as Weight Watchers®, Jenny Craig®, and L.A. Weight Loss® and self-help programs such as Overeaters Anonymous® and TOPS®[*]. These programs are highly popular and are effective for many. For example, Weight Watchers has enrolled more than 25 million people throughout the world in the last 40 years (Womble, Wang, & Wadden, 2004). Although these programs are typically designed by health professionals, they are usually administered by laypersons. Thus, they may be most appropriate for overweight individuals who do not have other significant health problems. This is not the case for most bariatric surgical candidates who commonly have multiple serious comorbidities (e.g., hypertension and type 2 diabetes) that require close medical management (ASBS, 2003).

The importance of physical exercise in weight loss is widely accepted and is an indispensable part of all weight reduction programs. Although exercise alone is often sufficient to cause some weight loss (Blair, 1993), life-long change in eating pattern is necessary to sustain weight loss. Thus, behavior modification programs are based on

[*] These are all registered trademarked names of the following companies, respectively: Weight Watchers International, Inc., http://www.weightwatchers.com ; Jenny Craig, Inc., http://www.jennycraig.com/corporate/aup.asp ; L A Weight Loss Centers, http://www.laweightlosscenters.com/default.aspx ; Overeaters Anonymous, Inc., http://www.oa.org/index.htm ; and TOPS Club, Inc., http://www.tops.org

altering lifestyles and eating behavior (Brannon & Feist, 2000). Such programs include the Duke Diet & Fitness Center and Pritikin*,* which are residential programs conducted by a multidisciplinary team of professionals. In these programs individual treatment plans are formulated and may include weight loss medication as well as the standard fare of nutritional counseling and exercise regimens (Womble et al., 2002). However, for various reasons, not all obese individuals profit from behavior modification programs alone (White & White, 1988).

Interestingly, similar to the concept to which Polivy and Herman (1983) alluded in their earlier referenced book, dieting often has a paradoxical effect and may actually help to promote obesity. Weight-cycling, sometimes called the yo-yo dieting effect, is a common phenomenon in which a person repeatedly loses and regains weight. Further, the weight regained is usually more than was initially lost. Weight cycling is thought to be linked with certain health risks such as negative impact on the immune system (e.g., Ulrich, 2004), risk factors for coronary heart disease, increased risks for all-cause mortality (Borkan, Sparrow, Wisniewski & Vokonas, 1986; Lissner et al., 1991), and development of binge eating behaviors (Patton et al., 1990). Cross-sectional studies have been consistent in finding a positive relationship between weight cycling and binge eating (Bartlett, Wadden, & Vogt, 1996; Vendetti, Wing, Jakicic, Butler, & Marcus, 1996; Yanovski, Gormally, Lesser, Gwirtsman, & Yanovski, 1994). Although these findings cannot infer causation, it is possible that binge eating leads to obesity, which is followed by the cycle of efforts to lose weight, which leads to more weight gain, rather than binge eating being the cause of weight-cycling (Wadden, Womble, Stunkard, & Anderson, 2002).

In summary, millions of morbidly obese individuals are continually striving to lose excess weight through exercise, self-directed programs, commercial weight loss plans, and behavior modification programs. However, most fail in the process, often getting more discouraged and even more obese as a result (Melanson & Dwyer, 2002). Further, a publication from the American Society for Bariatric Surgery (2003) states, "Dietary weight loss attempts cause depression, anxiety, irritability, weakness, and preoccupation with food…temporary fluctuations of body weight from calorie restricted diets should be avoided" (p. 4).

Bariatric Surgery

Given that non-surgical approaches to weight loss for morbid obesity are mostly ineffective and often controversial, weight loss surgery is a viable option and perhaps the only option for individuals whose BMIs are greater than 40 kg/m^2 as well as for patients with BMIs greater than 30 kg/m^2 in the presence of severe comorbidity (Balsiger, Murr, Poggio, & Sarr, 2000; DiCosmo et al., 2000; Jones, 2000). The current obesity epidemic has resulted in many new surgical interventions that are recognized as a mainstream approach to the treatment of refractory obesity. As such, the number of bariatric surgeries performed in the United States between 1998 and 2002 increased 400% and will likely continue to increase as a function of insurance companies' willingness to provide coverage. Clinics specializing in bariatric surgery are widespread throughout the United States and Europe as more surgeons are trained and more potential surgical candidates are made aware of these options (Encosa, Bernard, Steiner, & Chen, 2005). However, bariatric surgery is not a new concept.

The concept of bariatric surgery evolved from the observations of general surgeons shortly after World War II who observed weight loss in their patients that developed a condition known as short-gut syndrome. Short-gut syndrome is an iatrogenically induced condition caused by the removal of significant portions of the small intestine as a consequence of acute thrombosis of the arterial systems resulting in necrosis. Weight loss in this instance is due to the decreased absorptive area of the small intestine, which results in malabsorption, maldigestion, and post operative chronic severe diarrhea that often leads to serious medical consequences (e.g., calcium-oxalate kidney stones). There are also serious psychosocial consequences as well with this condition such as acute stress precipitated by the need to have a bathroom immediately available after eating. Consequently, patients soon learned that if they wanted to have a job or a social life after major bowel resection, then eating would need to be severely restricted. However, rather than viewing short-gut syndrome as a major liability for those unfortunate enough to have this experience, surgeons in several university centers made “the intellectual leap” and began to consider intentionally creating short-gut syndrome for treatment of severe obesity. Nevertheless, the severity of complications precluded this “first-generation” procedure from actual clinical practice. Over the years new techniques were introduced and surgical practices and procedures evolved into basic techniques that are considered mainstream and relatively safe by today’s standard (Martin, 2004b).

Currently there are essentially three types of bariatric surgical procedures. Malabsorptive techniques reduce the amount of intestine that comes into contact with food so that the body absorbs fewer calories (e.g., biliopancreatic division). Restrictive procedures make the stomach smaller to limit the amount of food intake (e.g., laparoscopic banding). There are also combinations of the two procedures (e.g., Roux-en-Y gastric bypass) (National Institute of Diabetes and Digestive and Kidney Diseases [NIDDK], 2004).

Although there are inherent risks in all surgical procedures, laparoscopic procedures are widely recognized as a safe and effective method of achieving and sustaining weight loss for the seriously obese patient. Thus, it is a viable alternative to open surgical techniques such as gastric bypass (ASBS, 2003; Dixon & O'Brien, 2002a). Laparoscopic banding offers the advantages of shortened hospital stays, improved postoperative course, better cosmetic results, adjustability, an earlier return to normal activities, and the option of future reversal (i.e., removal of the band) if necessary (Duckno, Ovnat & Levy, 2003). The LAP-BAND® system[*] is currently the only FDA approved laparoscopic banding system (June 2001) and thus the only system of its type available in the United States. The first LAP-BAND surgery was performed in 1993 and has since been utilized in over 250,000 procedures worldwide (INAMED, 2007).

All laparoscopic banding systems consist of a silicone ring that is placed around the upper part of the stomach creating a new small stomach pouch. This leaves the larger part of the stomach (the storage area) below the band reduced as well. The band controls the stoma, the stomach outlet, between the two parts of the stomach. The size of the stoma regulates the flow from the upper part of the stomach to the lower part of the stomach. With a smaller stoma, the individual feels full. Consequently, the feeling of hunger between meals is usually reduced. The band is connected by tubing to an

[*] Allergan, Inc., http://www.lapband.com/lapband/portal.do

access port that is placed beneath the skin during surgery. The port allows saline to be added or subtracted to the band which changes the size of the stoma. This, in turn, helps drive the rate of weight loss by restricting the volume of food intake. An added benefit to this system is that, unlike other bariatric procedures, it is completely reversible (INAMED, 2007).

Laparoscopic banding surgery requires more interaction between patients and the multidisciplinary team for the patient to be successful. This is because there are not as many physiological factors aiding weight loss as there are in other types of bariatric surgeries such as those based on malabsorptive principles (Martin, 2004a). Accordingly, the rate of weight loss with the laparoscopic banding is usually not as rapid as with other bariatric surgical methods (INAMED, 2005). Postoperative complications, although relatively few, have been found to be associated with therapeutic outcome. For example, incomplete food chewing or eating and drinking too fast often cause vomiting. Structural defects can occur from overeating (e.g., dilatation of the esophagus, slippage or erosion of the band) (Raum, 2004). Thus, the ability and willingness to adopt new eating patterns are paramount (Favretti, O’Brien, & Dixon, 2002; Gertler & Ramsey-Stewart, 1986; Hotter et al., 2003). It appears imperative, then, that eating behaviors in presurgical bariatric patients be explored in order to better identify patterns or profiles that may be predictive of post surgical outcome. At the same time, it is equally important to identify assessment tools that render useful and predictive data in order to plan appropriate pre and post surgical interventions.

Purpose and Rationale for Study

Based on the premise that successful weight loss with the laparoscopic banding procedure depends largely on the patient's capacity to make life-long behavioral changes, it is intuitive that presurgical eating behaviors would be a significant predictor of post surgical outcome. Studies have indicated that individuals who score high on both cognitive restraint and cognitive disinhibition are highly susceptible to a disinhibition effect (e.g., Westenhoefer, Broeckman, Munch, & Pudel, 1994) which is thought to predict nonadherence to non-surgical weight loss interventions such as calorie and quantity restrictive diets (e.g., LaPorte & Stunkard, 1990). The ability to adhere to such rigorous changes in eating behavior is essential to post surgical laparoscopic banding success. Furthermore, most bariatric surgical candidates are unsuccessful life-long dieters with a history of weight cycling which is also thought to be associated with an eating pattern of cognitive restraint followed by disinhibition. Thus, the EI, which assesses these factors (i.e., cognitive restraint, disinhibition, and hunger), is an often used assessment tool in presurgical evaluations of laparoscopic banding patients. Nevertheless, predictors of weight loss after laparoscopic banding surgery remain elusive even with the inclusion of measures such as the EI in presurgical batteries. In that the structure of the EI lends itself to the formulation of profiles, which have proven diagnostically useful in other assessment tools such as the Health Attribution Test (HAT;Achterberg & Lawlis, 1990), it is intuitive that such profiles may be predictive of post surgical outcome in bariatric patients. The purpose of this study, then, is to examine the presurgical eating behavior profiles derived from the three factors (cognitive restraint, disinhibition, & hunger) of the EI as a predicting factor of successful weight loss in bariatric laparoscopic banding patients.

Hypotheses

Based on the current literature of restraint theory and patterned after the HAT (Achterberg & Lawlis, 1990), the following hypotheses are offered:

- Hypothesis 1A: High Cognitive Restraint Profile (High CR)

Individuals who have a high CR profile will be in the normal weight loss group as measured by post surgical weight loss of 26 pounds or more at 6 months and 39 pounds or more at 9 months.

- Hypothesis 1B: Super High Cognitive Restraint Profile (Super High CR)

Individuals who have a super high CR profile will be in the normal weight loss group as measured by post surgical weight loss of 26 pounds or more at 6 months and 39 pounds or more at 9 months.

- Hypothesis 2A: High Disinhibition Profile (High D)

Individuals who have a high D profile will be in the low weight loss group as measured by post surgical weight loss of less than 26 pounds at 6 months and less than 39 pounds at 9 months.

- Hypothesis 2B: Super High Disinhibition Profile (Super High D)

Individuals who have a super high D profile will be in the low weight loss group as measured by post surgical weight loss of less than 26 pounds at 6 months and less than 39 pounds at 9 months.

- Hypothesis 3A: High Hunger Profile (High H)

Individuals who have a high H profile will be in the normal weight loss group as measured by post surgical weight loss of 26 pounds or more at 6 months and 39 pounds or more at 9 months.

- Hypothesis 3B: Super High Hunger Profile (Super High H)

Individuals who have a super high H profile will be in the low weight loss group as measured by post surgical weight loss of less than 26 pounds at 6 months and less than 39 pounds at 9 months.

- Hypothesis 4: Null Profile

Individuals who have a low-average CR, D, H profile will be in the normal weight loss group as measured by post surgical weight loss of 26 pounds or more at 6 months and 39 pounds or more at 9 months.

CHAPTER III

METHOD

Participants

This study is a retrospective charts study that included128 morbidly obese patients who underwent surgery at the Bariatric Surgical Clinic at University of North Texas Health Science Center (UNTHSC) from January 2002 through July 2004. Inclusion criteria were consistent with criteria required by the UNTHSC Bariatric Surgery Clinic. Patients must be over the age of 18 years and have a body mass index (BMI) $\geq$ 40kg/m^2 or BMI $\geq$30 kg/m^2 with significant comorbidities. Patients received the procedure from one of two surgeons in the practice who have been trained in the same surgical technique.

Weight loss was recorded at 6 months and 9 months post laparoscopic banding surgery. Presurgical raw scores on the three factors of the Eating Inventory® test[*] (EI) were collected along with height, presurgical weight, and presurgical BMI. Demographic data recorded were gender, age, ethnicity, marital status, and education.

Measure

Each participant completed the EI as part of a standard pre-operative assessment battery. The EI was developed by Stunkard and Messick (1985) to further investigate the concept of restrained eating proposed by Herman and Mack (1975) and as a successor to their Restraint Scale. The EI assesses three dimensions of eating behavior in both adolescents and adults: cognitive restraint, disinhibition, and hunger. The measure was designed for a variety of uses including assessment of eating

[*] Harcourt Assessment, Inc., http://harcourtassessment.com

disorders and obesity both pre and post treatment, as well as to determine the effects of weight changing conditions such as smoking cessation (Stunkard & Messick, 1985).

The EI is a two-part questionnaire composed of 36 true-false items in Part I and 15 rating-scale items in Part II. The inventory can be completed in about 10 to 15 minutes. The answer sheet has a built-in scoring system. The examiner tears the perforated answer sheet from the under sheet and counts the number of responses for each factor to obtain a raw score. Scores for each factor are then divided in the low to average range, high range, and clinical range. See Table 1 for interpretation of factor raw scores.

Table 1

Factor Raw Score Interpretation

Range	Factor I Cognitive Restraint	Factor 2 Disinhibition	Factor 3 Hunger
Low to Average	0-10	0-8	0-7
High	11-13	9-11	8-10
Clinical	$\geq$ 14	$\geq$ 12	$\geq$ 11

Psychometric Properties of the Eating Inventory (EI)

Reliability (internal consistency) was estimated with Cronbach's alpha. For each of the three factors (cognitive restraint, disinhibition, and hunger), coefficients were reported for a combined sample of 98 participants (53 restrained eaters and 45 unrestrained eaters). Coefficients ranged from 0.93 for the combined sample to 0.79 for the restrained eaters (Bloom, 1998).

Content validity was derived from a clinical basis as well as from the extensive literature on restraint and latent obesity. Evidence of construct validity was provided by factor analysis that clearly point to a coherent set of three constructs. Further, studies with clinical and control groups demonstrated that scores on each of the three factor-based scales differentiate between groups as predicted by theory and prior research on eating behavior (e.g., Marcus & Wing, 1983, as cited in Stunkard & Messick, 1985).

Formulation of EI Profiles

Patterned after the concept of the profile codes in the Health Attribution Test (HAT; Achterberg & Lawlis, 1990), the predictor variables were derived profiles formed from the scores on the three factors of the EI (cognitive restraint, disinhibition, and hunger). Based on restraint theory and the current literature, profiles were formed from the combinations of raw scores that were expected to produce a particular effect (e.g., disinhibition effect) or were either high or quite high (high/clinical range) or low (low to average range) in comparison with the other scores from which the profile was derived (see Tables 2 and 3).

- High cognitive restraint profile (high CR) – Profiles with high cognitive restraint scores and low disinhibition scores were placed in the high cognitive restraint (high CR) profile.
- Super high cognitive restraint profile (super high CR) – Profiles with scores that were in the clinical range on cognitive restraint with low to average disinhibition scores were placed in the super high cognitive restraint (super high CR) profile.
- High disinhibition profile (high D) – A “disinhibition effect” is thought to occur when scores are high in both cognitive restraint and disinhibition (Westenhoeffer, Broweckmann, Munch, & Pudel, 1994). Thus, profiles that were high on both cognitive restraint and disinhibition were placed in the high disinhibition (high D) profile. Profiles with high scores on disinhibition and low to average on cognitive restraint were also placed in the high D profile as were profiles that were clinical on cognitive restraint and high on disinhibition.

- Super high disinhibition profile (super high D) – Profil*es* with scores in the clinical range on both cognitive restraint and disinhibition were placed in the super high disinhibition (super high D) profile as were profiles in which disinhibition scores were in the clinical range and cognitive restraint scores were in the low to average range.
- High hunger profile (high H) – Profiles with scores that were in the high range on hunger with cognitive restraint and disinhibition scores in the low to average ranges were placed in the high hunger (high H) profile.
- Super high hunger profile (super high H) – Profil*es* that were in the clinical range on hunger with cognitive restraint and disinhibition scores in the low to average range were placed in the super high hunger (super high H) profile.
- Null profile – Profile*s* in which all three scores were in the low to average range were placed in the null profile.

Variables

Outcome variables were weight loss group (Normal Weight Loss or Low Weight Loss) post surgery at 6 months and at 9 months. Predictor variables were the derived EI profiles.

Statistical Methodology

Logistic regression allows a prediction of group membership from variables that may be discrete, continuous, or a mix. Profiles or cases (discrete variables) were derived from the three factors on the EI and used to predict into which weight loss group each profile would fall. Weight loss was divided into two groups: normal weight loss (NWL) and low weight loss (LWL) in accordance with criteria listed below. Logistic regression emphasizes the probability of a particular outcome of each case and has no assumptions about the distribution of the predictor variables. Predictors are not assumed to be normally distributed, linearly related, or of equal variance within each group (Tabachnick & Fidell, 2001). Research indicates that individuals with BMIs greater than 55 kg/m^2 tend to lose weight at a more rapid pace than those with lower BMIs. Further, due to slowing metabolism with age, weight loss has also been shown to vary as a function of age (Brolin, 2004). Accordingly, age and presurgical BMI were entered as covariates.

Weight Loss Group Criteria

INAMED Health, manufacturer of the LAP-BAND® system[*], states, "It is very important to set achievable weight-loss goals from the beginning. A weight loss of 2 to 3 pounds a week in the first year after the operation is possible, but one pound a week is more likely " (INAMED Corporation, 2005, p.1). Based on the fact that all participants received the LAP-BAND system procedure, weight loss groups were formed using the INAMED criteria of expected weight loss of 1 pound per week. Thus, participants with weight loss of 26 pounds or more at 6 months post surgery and 39 pounds or more at 9 months post surgery were placed in the normal weight loss group. Participants with weight loss less than 26 pounds at 6 months post-surgery and less than 39 pounds at 9 months post surgery were placed in the low weight loss group.

[*] Allergan, Inc., http://www.lapband.com/lapband/portal.do

Table 2

Profiles for 6 Month Data Set

EI Profile	EI Subscale Scores CR	D	H	Total Cases
High CR	High	Low	Low	13
	High	Low	High	
	High	Low	Clinical	
Super High CR	Clinical	Low	Low	15
	Clinical	Low	High	
High D	Low	High	Low	28
	Low	High	High	
	Low	High	Clinical	
	High	High	Low	
	High	High	High	
	High	High	Clinical	
	High	Clinical	Low	
	High	Clinical	High	
	High	Clinical	Clinical	
	Clinical	High	Low	
	Clinical	High	High	
Super High D	Low	Clinical	Low	25
	Low	Clinical	High	
	Low	Clinical	Clinical	
	Clinical	Clinical	Low	
	Clinical	Clinical	High	
	Clinical	Clinical	Clinical	
High H	Low	Low	High	11
Super High H	Low	Low	Clinical	5
Null	Low	Low	Low	12
Total				109

Note: CR = cognitive restraint; D = disinhibition; H = hunger.

Table 3

Profiles for 9 Month Data Set

EI Profile	EI Subscale Scores			Total Cases
	CR	D	H	
High CR	High	Low	Low	15
	High	Low	High	
	High	Low	Clinical	
Super High CR	Clinical	Low	Low	11
	Clinical	Low	High	
High D	Low	High	Low	29
	Low	High	`High	
	Low	High	Clinical	
	High	High	Low	
	High	High	High	
	High	High	Clinical	
	High	Clinical	Low	
	High	Clinical	High	
	High	Clinical	Clinical	
	Clinical	High	Low	
	Clinical	High	High	
	Clinical	High	Clinical	
Super High D	Low	Clinical	Low	25
	Low	Clinical	High	
	Low	Clinical	Clinical	
	Clinical	Clinical	Low	
	Clinical	Clinical	High	
	Clinical	Clinical	Clinical	
High H	Low	Low	High	11
Super High H	Low	Low	Clinical	5
Null	Low	Low	Low	12
Total				109

Note: CR = cognitive restraint; D = disinhibition; H = hunger.

CHAPTER IV

RESULTS

Descriptive Statistics

Of the 128 cases reviewed, 23 were men and 105 were women, representing 18% and 82% of the samples respectively. Ages ranged from 23 to 70 years (M = 44.23, SD = 11.06) (see Table 4). Caucasians represented 83.6% of the cases reviewed, followed by Hispanics at 5.5%, African Americans at 3.9%, and Asians at 1.6%. One cased reported ethnicity of “other” (0.8%) and 4.6% did not report race/ethnicity (see Table 5).

Table 4

Gender Overall Sample

Gender	Frequency	Percent
Male	23	18.0
Female	105	82.0
Total	128	100.0

Table 5

Ethnicity Overall Sample

	Frequency	Percent	Cumulative Percent
Caucasian	107	83.6	83.6
Hispanic/Latino	7	5.5	89.1
African American	5	3.9	93.0
Asian American	2	1.6	94.6
Other	1	0.8	95.4
Not Reported	6	4.6	100.0
Total	128	100.0	100.0

Of the 128 sampled cases, 59.4% were married, 10.9% single, 20.3% divorced or separated, and 9.4% did not report marital status (see Table 6). Educational achievement for the sample was reported as follows: 5.5% had less than high school diploma, 29.7% had a high school diploma or a general equivalency degree, 27.3% had some college, 14.1% had a bachelor's degree, 12.5% had a graduate degree, and 10.9% did not report education level (see Table 7).

Table 6

Marital Status Overall Sample

	Frequency	Percent	Cumulative Percent
Married	76	59.4	59.4
Single	14	10.9	70.3
Divorced/Separated	26	20.3	90.6
Not Reported	12	9.4	100.0
Total	128	100.0	100.0

Table 7

Education Achieved Overall Sample

	Frequency	Percent	Cumulative Percent
< High School	7	6.1	6.1
High School/GED	38	29.7	35.2
Some College	35	27.3	62.5
Undergrad. Degree	18	14.1	76.6
Graduate Degree	16	12.5	89.1
Not reported	14	10.9	100.0
Total	128	100.0	100.0

Height ranged from 60 inches to 74 inches (*M* = 65.60, *SD* = 3.50). Initial weight ranged from 189 pounds to 501 pounds (*M* = 295.60, *SD* = 59.70). Initial BMI ranged from 32.40 to 74.0 (*M* = 48.01, *SD* = 7.94) (see Table 8).

Table 8

Mean Age, Height, Weight, BMI Overall Sample

	Range	Mean	*SD*
Age	23 - 70	44.23	11.06
Height	60" - 74"	65.60	3.50
Initial Weight	189 - 501	295.59	59.70
Initial BMI	32.4 - 74.0	48.08	7.94

EI raw subscale scores were as follows: Cognitive Restraint (CR) ranged from 2 to 18 (*M* = 9.1, *SD* = 4.0). Disinhibition (D) ranged from 0 to 16 (*M* = 8.8, *SD* = 3.73). Hunger (H) ranged from 0 to 15 (*M* = 8.4, *SD* = 3.54). (see Table 9).

Table 9

EI Factor Raw Scores Overall Sample

	Range	Mean	*SD*
Cognitive Restraint	2 - 18	9.15	4.00
Disinhibition	0 – 16	8.80	3.73
Hunger	1 – 15	8.40	3.54

Statistical Findings

Direct logistic regression analysis was performed on weight loss group as outcome and profiles derived from the three factors on the EI as predictors. Analysis was performed using the SPSS version 11.5. Tables A-1 and A-2 in the appendix show regression coefficients, standard error, Wald statistic, Cox-Snell R^2, Nagelkerke R^2, Hosmer-Lemeshow tests, and percentage above chance performance for each of the predictors at 6 and 9 months post surgery.

Direct logistic regression analysis indicated mixed predictive ability of the profile system model for weight loss group when applied at the 6 month and 9 month time intervals. Age and presurgical BMI were entered as covariates (see Table 10).

Table 10

Overall Predictability of Profile Model

	6 mos predicted	6 mos. actual, n = 109; NWL$\geq$= 26 lbs	9 mos predicted	9 mos. actual, n = 109; NWL$\geq$= 39 lbs
Low Wt. Loss	58	18	59	29
Normal Wt. Loss	51	91	50	80

Six Month Analysis Profile Model

Power = 0.9998 with effect size between low weight loss (LWL) and normal weight loss (NWL) groups' pounds lost at the 6 month post surgical time interval (Cohen's d = 1.4490), 1 tailed, α=.05.

Hypothesis 1A: High Cognitive Restraint

The high cognitive restraint profile was found in 13 individuals in the sample. The hypothesis predicted this profile to result in weight loss of 26 pounds or more at the 6 month post surgical time interval. Eleven of the 13 individuals lost 26 or more pounds after 6 months. The model met statistical significance criteria with the Wald statistic, X^2

(1,109) = 4.918, p = .027. R^2_{CS} = .281 and R^2_N = .487, indicating that the model is a good fit. Additionally, the Hosmer and Lemmeshow test was not significant (p = .583), also indicating a good fit of the model with this sample. Of the 13 cases predicted to be in the NWL group, the model correctly predicted 11 cases, with an overall 34.6% greater than chance predictive ability of this profile. This hypothesis was supported with this sample.

Hypothesis1B: Super High Cognitive Restraint Profile (Super High CR)

The super high cognitive restraint profile was found in 15 individuals in the sample. The hypothesis predicted this profile to result in weight loss of 26 or more pounds at the 6 month post surgical time interval. Twelve of the 15 individuals lost 26 or more pounds after 6 months. The model met statistical significance criteria with the Wald statistic, X^2 (1,109) = 4.612, p = .032. R^2_{CS} = .060 and R^2_N = .096, indicating that the model is a good fit. The Hosmer and Lemmeshow test was not significant (p = .439), also indicating a good fit of the model with this sample. Of the 15 cases predicted to be in the NWL group, the model correctly predicted 12 cases, with an overall 30.0% greater than chance predictive ability of this profile. This hypothesis was supported with this sample at 6 months post surgery.

Hypothesis 2A: High Disinhibition Profile (High D)

The high disinhibition profile was found in 28 individuals in the sample. The hypothesis predicted this profile to result in weight loss of less than 26 pounds at the 6 month post surgical time interval. Five of the 28 individuals lost less than 26 pounds after 6 months. The model met statistical significance criteria with the Wald statistic, X^2 (1,109) = 9.565, *p* = .002. R^2_{CS} = .026 and R^2_N = .042, indicating the model is a good fit. The Hosmer and Lemmeshow test was not significant *(p* = .643), also indicating that the model is a good fit with this sample. Of the 28 cases predicted to be in the LWL group, the model correctly predicted 5 cases, with an overall 32.1% greater than chance predictive ability of this profile towards NWL group, rather than the predicted LWL group. This hypothesis is not supported with this sample at 6 months post surgery.

Hypothesis 2B: Super High Disinhibition Profile (Super High D)

The super high disinhibition profile was found in 25 individuals in the sample. The hypothesis predicted this profile to result in weight loss of less than 26 pounds at the 6 month post surgical time interval. Five of the 25 individuals lost less than 26 pounds after 6 months. The model indicates statistical significance criteria with the Wald statistic, X^2 (1,109) = 7.687, *p* = .006, R^2_{CS} = .187 and R^2_N = .296, indicating the model is a good fit. Additionally, the Hosmer and Lemmeshow test was not significant *(p* = .212), indicating a good fit of the model with this sample. Of the 25 cases predicted to be in the LWL group, the model correctly predicted 5 cases, with an overall 30% greater than chance predictive ability of this profile towards NWL group, rather than the predicted LWL group. This hypothesis is not supported with this sample at 6 months post surgery.

Hypothesis 3A: High Hunger Profile (High H)

The high hunger profile was found in 11 individuals in the sample. The hypothesis predicted this profile to result in weight loss of 26 pounds or more at the 6 month post surgical time interval. Eight of the 11 individuals lost 26 pounds or more after 6 months. The model failed statistical significance criteria with the Wald statistic, X^2 (1,109) = 2.099, p = .147, R^2_{CS} = .165 and R^2_N = .240. Of the 11 cases predicted to be in the NWL group, the model correctly predicted 8 cases, with an overall 31.8% greater than chance predictive ability of this profile towards normal weight loss. This hypothesis is not supported with this sample at 6 months post surgery.

Hypothesis 3B: Super High Hunger Profile (Super High H)

The super high hunger profile was found in 5 individuals in the sample. The hypothesis predicted this profile to result in weight loss less than 26 pounds at the 6 month post surgical time interval. Since all 5 individuals lost 26 pounds or more after 6 months, the model could not be tested. This hypothesis is not supported with this sample at 6 months post surgery.

Hypothesis 4: Null Profile

The null profile was found in 12 individuals in the sample. The hypothesis predicted this profile to result in weight loss greater than or equal to 26 pounds at the 6 month post surgical time interval. Since all 12 individuals lost 26 pounds or more after 6 months, the model could not be tested. However, this hypothesis is supported with this sample at 6 months post surgery.

Summary

In summary, 3 hypotheses were supported and 4 were not supported at 6 months post surgery (see Table 11).

Table 11

Hypothesis Testing 6 Months Data Set

Hypothesis	Predicted Group	Profile *n* Results	Hypothesis Supported?
1A: High Cognitive Restraint Profile	NWL	13 NWL=11 LWL= 2	Yes
1B: Super High Cognitive Restraint Profile	NWL	15 NWL=12 LWL= 3	Yes
2A: High Disinhibition Profile	LWL	28 NWL=23 LWL= 5	No
2B: Super High Disinhibition Profile	LWL	25 NWL=20 LWL= 5	No
3A: High Hunger Profile	NWL	11 NWL=8 LWL= 3	No
3B: Super High Hunger Profile	LWL	5 NWL= 5 LWL= 0	No
4: Null Profile	NWL	12 NWL=12 LWL= 0	Yes

Nine Month Analysis Profile Model

Power = 1.000 with effect size between LWL and NWL groups pounds lost at the nine month post surgical time interval (Cohen's d = 1.4734), 1 tailed, α = .05.

Hypothesis 1A: High Cognitive Restraint

The high cognitive restraint profile was found in 15 individuals in the sample. The hypothesis predicted this profile to result in weight loss of 39 pounds or more at the 9 month post surgical time interval. Nine (9) of the 15 individuals lost 39 or more pounds after 9 months. The model failed statistical significance criteria with the Wald statistic, X^2 (1,109) = .592, p = .442. R^2_{CS} =.013 and R^2_N = .018, indicating the model is not a good fit. The Hosmer and Lemmeshow test was not significant (p = .168), indicating a marginally good strength of association with this sample. Of the 15 cases predicted to be in the NWL group, the model correctly predicted 9 cases, with an overall 10.0% greater than chance predictive ability of this profile. This hypothesis is not supported with this sample at 9 months post surgery.

Hypothesis 1B: Super High Cognitive Restraint Profile (Super High CR)

The super high cognitive restraint profile was found in 11 individuals in the sample. The hypothesis predicted this profile to result in weight loss of 39 pounds or more at the 9 month post surgical time interval. Ten of the 11 individuals lost 39 or more pounds after 9 months. The model met statistical significance criteria with the Wald statistic, X^2 (1,109) = 4.820, p = .028. R^2_{CS} = .013 and R^2_N = .029, indicating the model is a good fit. Additionally, the Hosmer and Lemmeshow test was not significant (p = .248), indicating a good fit of the model with this sample. Of the 11 cases predicted to be in the NWL group, the model correctly predicted 10 cases, with an overall 40.9% greater than chance predictive ability of this profile. This hypothesis is supported with this sample at 9 months post surgery.

Hypothesis 2A: High Disinhibition Profile (High D)

The high disinhibition profile was found in 29 individuals in the sample. The hypothesis predicted this profile to result in weight loss of less than 39 pounds at the 9 month post surgical time interval. Eight of the 29 individuals lost less than 39 pounds after 9 months. The model indicates statistical significance criteria with the Wald statistic, X^2 (1,109) = 5.396, p = .020. R^2_{CS} = .217 and R^2_N = .314, indicating the model is a good fit. The Hosmer and Lemmeshow test was not significant (p = .538), also indicating a good fit of the model with this sample. Of the 29 cases predicted to be in the LWL group, the model correctly predicted 8 cases, with an overall 32.8% greater than chance predictive ability of this profile towards NWL group, rather than the predicted LWL group. This hypothesis is not supported with this sample at 9 months post surgery.

Hypothesis 2B: Super High Disinhibition Profile (Super High D)

The super high disinhibition profile was found in 25 individuals in the sample. The hypothesis predicted this profile to result in weight loss of less than 39 pounds at the 9 month post surgical time interval. Five of the 25 individuals lost less than 39 pounds after 9 months. The model met statistical significance criteria with the Wald statistic, X^2 (1,109) = 7.687, p = .006, R^2_{CS} = .112 and R^2_N = .177. The Hosmer and Lemmeshow test was not significant (p = .448), indicating a good fit of the model with this sample. Of the 25 cases predicted to be in the LWL group, the model correctly predicted 5 cases, with an overall 30% greater than chance predictive ability of this profile towards NWL group, rather than the predicted LWL group. This hypothesis is not supported with this sample at 9 months post surgery.

Hypothesis 3A: High Hunger Profile (High H)

The high hunger profile was found in 11 individuals in the sample. The hypothesis predicted this profile to result in weight loss of 39 pounds or more at the 9 month post surgical time interval. Six of the 11 individuals lost 39 pounds or more after 9 months. The model failed statistical significance criteria with the Wald statistic, X^2 (1,109) = .091, p = .763, R^2_{CS} = .074 and R^2_N = .100, indicating the model is not a good fit. Of the eleven cases predicted to be in the NWL group, the model correctly predicted 6 cases, with an overall 13.6% greater than chance predictive ability of this profile towards NWL group. This hypothesis is not supported with this sample at 9 months post surgery.

Hypothesis 3B: Super High Hunger Profile (Super High H)

The super high hunger profile was found in 5 individuals in the sample. The hypothesis predicted this profile to result in weight loss less than 39 pounds at the 9 month post surgical time interval. The model failed statistical significance criteria with the Wald statistic, X^2 (1,109) = 1.537, p = .215, R^2_{CS} = .632 and R^2_N = 1.00 indicating the model is not a good fit. Of the 5 cases predicted to be in the LWL group, the model correctly predicted 1 case, with an overall 50% greater than chance predictive ability of this profile towards NWL group rather than the predicted LWL group. This hypothesis is not supported with this sample at 9 months post surgery.

Hypothesis 4: Null Profile

The null profile was found in 13 individuals in the sample. The hypothesis predicted this profile to result in weight loss of 39 pounds or more at the 9 month post surgical time interval. The model approached statistical significance criteria with the Wald statistic, X^2 (1,109) = 3.345, p = .067. R^2_{CS} = .480 and R^2_N = .727, indicating the model is a marginally good fit. Additionally, the Hosmer and Lemmeshow test was not significant (p = .783), indicating a good fit of the model with this sample. Of the 13 cases predicted to be in the NWL group, the model correctly predicted 10 cases, with an overall 34.6% greater than chance predictive ability of this profile. This hypothesis is supported with this sample at 9 months post surgery.

Summary

In summary, 2 hypotheses were supported and 5 were not supported at 9 months post surgery (see Table 12).

Table 12

Hypothesis Testing 9 Months Data Set

Hypothesis	Predicted Group	Profile *n* Results	Hypothesis Supported?
1A: High Cognitive Restraint Profile	NWL	15 NWL= 9 LWL= 6	No
1B: Super High Cognitive Restraint Profile	NWL	11 NWL=10 LWL= 1	Yes
2A: High Disinhibition Profile	LWL	29 NWL=21 LWL= 8	No
2B: Super High Disinhibition Profile	LWL	25 NWL=20 LWL= 5	No
3A: High Hunger Profile	NWL	11 NWL= 6 LWL= 5	No

(table continues)

Table 12 *(continued).*

Hypothesis	Predicted Group	Profile *n* Results	Hypothesis Supported?
3B: Super High Hunger Profile	LWL	5 NWL= 4 LWL= 1	No
4: Null Profile	NWL	13 NWL=10 LWL= 3	Yes

Additional Analysis - General Factor Model

In order to compare the predictive ability of the profiles to the general factors alone (cognitive restraint, disinhibition, and hunger), direct logistic regression analysis was performed using weight loss group at 6 and 9 months post surgery as outcome. Table 13 shows the assumed predictions for the factor scores based upon the clinical interpretations and guidelines in the *Eating Inventory Manual* (Stunkard & Messick, 1988).

Table 13

Assumptions for Predictions General Factor Model

Factor	Score Range	Assumed Prediction
Cognitive Restraint	High or Clinical	Normal Weight Loss
	Low	Low Weight Loss
Disinhibition	High or Clinical	Low Weight Loss
	Low	Normal Weight Loss
Hunger	High or Clinical	Low Weight Loss
	Low	Normal Weight Loss

Six Months Analysis General Factor Model

- *Cognitive restraint factor.* High or clinical scores on cognitive restraint were found in 39 individuals in the sample. Using the general factor model, these individuals were predicted to place in the NWL group with weight loss of 26 pounds or more at the 6 month post surgical time interval. Thirty-three of the 39 lost 26 pounds or more. Of the 39 cases predicted to be in the NWL group, the general factor model correctly predicted 33 cases with an overall 34.6% greater than chance predictive ability of cognitive restraint general factor towards normal weight loss in this sample at 6 months post surgery.

Low to average scores on cognitive restraint were found in 70 individuals in the sample. Using the general factor model, these individuals were predicted to place in LWL group with weight loss of less than 26 pounds at the 6 month post surgical time interval. Of the 70 individuals predicted to be in the LWL group, the general factor model correctly predicted 12 cases with an overall 32.9% greater than chance predictive ability of the cognitive restraint general factor toward low weight loss in this sample at 6 months post surgery.

The model met statistical significance criteria with Wald statistic, $X^2(1,109) = 14.754$, $p = .000$, $R^2cs = .079$, $R^2n = .137$. The Hosmer and Lemeshow test was not significant (p=.595), also indicating a good fit of the model with this sample.

- *Disinhibition factor.* High or clinical scores on disinhibition were found in 53 individuals in the sample. Using the general factor model, these individuals were predicted to fall in the LWL group to result in weight loss of less than 26 pounds at the 6 month post surgical time interval. Ten of the 53 individuals lost less than 26 pounds at the six month time interval. Of the 53 cases predicted to be in the LWL group, the general factor model correctly predicted 10 cases with an overall 31.1% greater than chance predictive ability of the disinhibition general factor towards low weight loss with this sample at 6 months post surgery.

Low scores on disinhibition were found in 56 individuals in the sample. Using the general factor model, these individuals were predicted to fall in the NWL group to result weight loss of 26 pounds or more at the 6 month post surgical time interval. Of the 56 individuals predicted to be in the NWL group, the model correctly predicted 48 cases with an overall 35.7% greater than chance predictive ability of the disinhibition general factor toward normal weight loss with this sample at 6 months post surgery.

The model met statistical significance criteria with Wald statistic, $X^2(1,109) = 22.014$, $p = .000$, $R^2cs = .012$, $R^2n = .032$. The Hosmer and Lemeshow test was not significant ($p = .643$), also indicating a good fit of the model with this sample.

- *Hunger factor.* High or clinical scores on hunger were found in 67 individuals in the sample. Using the general factor model, these individuals were predicted to fall in the LWL group to result in weight loss of less than 26 pounds at the 6 month post surgical time interval. Thirteen of the 67 individuals lost less than 26 pounds at the six month time interval. Of the 67 cases predicted to be in the LWL group, the general factor model correctly predicted 13 cases with an overall 30.6% greater than chance predictive ability of the disinhibition general factor towards low weight loss with this sample at 6 months post surgery.

Low scores on hunger were found in 42 individuals in the sample. Using the general factor model, these individuals were predicted to fall in the NWL group to result in weight loss of 26 pounds or more at the 6 month post surgical time interval. Of the 42 individuals predicted to be in the NWL group, the model correctly predicted 37 cases, with an overall 38.1% greater than chance predictive ability of the disinhibition general factor toward normal weight loss with this sample at 6 months post surgery.

The model met statistical significance criteria with Wald statistic, $X^2(1,109)$ = 17.645, p = .000, R^2cs = .002, R^2n = .042. The Hosmer and Lemeshow test was not significant (p= .654), also indicating a good fit of the model with this sample.

See Table 14 for summary of overall predictability of the general factor model with this sample at 6 months post surgery.

Table 14

General Factor Model

Months Post-surgery	Predicted Group	*n*	General Factor	Actual NWL	Actual LWL	% Correct	% > chance
6	NWL	39	CR	33	6	84.6	34.6
		56	D	48	8	85.7	35.7
		42	H	37	5	88.1	38.1
	LWL	70	CR	58	12	17.1	32.9
		53	D	43	10	18.9	31.1
		67	H	54	13	19.4	30.6
9	NWL	32	CR	23	9	71.9	21.9
		55	D	39	16	70.9	20.9
		40	H	28	12	70.0	25.0
	LWL	77	CR	57	20	26.0	24.0
		54	D	41	13	24.1	25.9
		69	H	52	17	24.6	25.4

Note: NWL = Normal weight loss, LWL = low weight loss; CR = cognitive restraint; D = disinhibition; H = hunger.

Nine Months Analysis General Factor Model

- *Cognitive restraint factor.* High or clinical scores on cognitive restraint were found in 32 individuals in the sample. Using the general factor model, these individuals were predicted to fall in the normal weight loss group (NWL) to in result in weight loss of 39 pounds or more at the 9 month post surgical time interval. Twenty-three of the 32 individuals lost 26 pounds or more. Of the 32 cases predicted to be in the NWL group, the general factor model correctly predicted 23 cases with an overall 21.9% greater than chance predictive ability of the cognitive restraint general factor towards normal weight loss in this sample at 9 months post surgery.

Low to average scores on cognitive restraint were found in 77 individuals in the sample. Using the general factor model, these individuals were predicted to fall in the low weight loss group (LWL) to result weight loss of less than 39 pounds at the 9 month post surgical time interval. Of the 77 individuals predicted to be in the LWL group, the model correctly predicted 20 cases with an overall 24.0% greater than chance predictive ability of the cognitive restraint general factor toward low weight loss in this sample at 9 months post surgery.

The model met statistical significance criteria with Wald statistic, $X^2(1,109) = 5.695$, $p = .017$, $R^2cs = .038$, $R^2n = .055$. The Hosmer and Lemeshow test was not significant (p=.917), also indicating a good fit of the model with this sample.

- *Disinhibition factor.* High or clinical scores on disinhibition were found in 54 individuals in the sample. Using the general factor model, these individuals were predicted to fall in the LWL group to result in weight loss of less than 39 pounds at the 9 month post surgical time interval. Thirteen of the 54 individuals lost less than 39 pounds at the 9 month time interval. Of the 54 cases predicted to be in the LWL group, the general factor model correctly predicted 13 cases with an overall 25.9% greater than chance predictive ability of the disinhibition general factor towards low weight loss with this sample at 9 months post surgery.

Low scores on disinhibition were found in 55 individuals in the sample. Using the general factor model, these individuals were predicted to fall in the NWL group to result weight loss of 29 pounds or more at the 9 month post surgical time interval. Of the 55 individuals predicted to be in the NWL group, the model correctly predicted 39 cases with an overall 20.9% greater than chance predictive ability of the disinhibition general factor toward normal weight loss with this sample at 9 months post surgery.

The model met statistical significance criteria with Wald statistic, $X^2(1,109)$ = 9.006, p = .003, R^2cs = .058, R^2n = .083. The Hosmer and Lemeshow test was not significant (p= .381), also indicating a good fit of the model with this sample.

- *Hunger factor.* High or clinical scores on hunger were found in 69 individuals in the sample. Using the general factor model, these individuals were predicted to fall in the LWL group to result in weight loss of less than 39 pounds at the 9 month post surgical time interval. Seventeen of the 69 individuals lost less than 39 pounds at the six month time interval. Of the 69 cases predicted to be in the LWL group, the general factor model correctly predicted 17 cases with an overall 24.6% greater than chance predictive ability of the disinhibition general factor towards low weight loss with this sample at 9 months post surgery.

Low scores on hunger were found in 40 individuals in the sample. Using the general factor model, these individuals were predicted to fall in the NWL group to result weight loss of 39 pounds or more at the 9 month post surgical time interval. Of the 40 individuals predicted to be in the NWL group, the model correctly predicted 28 cases with an overall 25.0% greater than chance predictive ability of the disinhibition general factor toward normal weight loss with this sample at nine months post surgery.

The model met statistical significance criteria with Wald statistic, $X^2(1,109)$ = 6.030, p = .014, R^2cs =.240, R^2n = .342. The Hosmer and Lemeshow test was not significant (p= .563), also indicating a good fit of the model with this sample.

See Table 14 for summary of overall predictability of the general factor model with this sample at 9 months post surgery.

As shown in Table 15, the high cognitive restraint profile and the super high cognitive restraint profile (84.6% and 86.6% respectively) appear to more accurately predict weight loss group than the single cognitive restraint factor (41.3%). Additionally, the high hunger profile (72.7%), but not the super high hunger profile (0.0%) appears to more accurately predict weight loss group than the hunger single factor (45.9%) in the 6 months post surgery sample.

As shown in Table 16, the high cognitive restraint profile and the super high cognitive restraint profile appear to more accurately predict weight loss group (60.0% and 90.9% respectively than the cognitive restraint single factor (39.4%) Additionally, the high hunger (54.5%) profile, but not the super high hunger profile (20.0%), appears to more accurately predict weight loss group than the hunger single factor (41.3%) in the 9 month post surgery sample.

Table 15

Overall Accuracy of Profiles versus Single Factors at 6 Months

Profile	Overall Accuracy of Actual vs. Theorized Outcomes (%)		Single Factor
High cognitive restraint	84.6	41.3	Cognitive Restraint
Super high cognitive restraint	86.6		
High disinhibition	17.8	53.2	Disinhibition
Super high disinhibition	20.0		
High hunger	72.7	45.9	Hunger
Super high hunger	0.0		

Table 16

Overall Accuracy of Profiles versus Single Factors at 9 Months

Profile	Overall Accuracy of Actual vs. Theorized Outcomes (%)		Single Factor
High cognitive restraint	60.0	34.4	Cognitive Restraint
Super high cognitive restraint	90.9		
High disinhibition	27.6	47.7	Disinhibition
Super high disinhibition	20.0		
High hunger	54.5	41.3	Hunger
Super high hunger	20.0		

CHAPTER V

DISCUSSION

The purpose of this study was to explore the efficacy of profiles, derived from the three factors (cognitive restraint, disinhibition, and hunger) of the Eating Inventory® test[*] (EI; Stunkard & Messnick, 1988), in predicting post surgical weight loss in laparoscopic banding patients. Although there have been no prior studies utilizing this method to predict post surgical weight loss in bariatric patients, the formulation of the profiles and the hypotheses offered were grounded in present theory and prior research of the restraint theory. The profiles were also influenced and patterned after the richness and diagnostic utility of the profiles generated by the Health Attribution Test (Achterberg & Lawlis, 1990).

Hypothesis 1A: High Cognitive Restraint Profile

The hypothesis that individuals with a high cognitive restraint profile (high CR) would place in the normal weight loss group (NWL) was supported at 6 months post surgery but not at 9 months post surgery for these samples. The high CR profile was comprised of individuals with high scores on the cognitive restraint factor and low scores on the disinhibition factor. Hunger scores ranged from low to clinical (see Tables 2 and 3).

It is thought that individuals with high scores on both cognitive restraint and disinhibition are highly susceptible to the "disinhibition effect" or loss of control in the presence of disinhibiting triggers (e.g., Westenhofer et al., 1994). Accordingly, it is intuitive that high cognitive restraint without the accompanying high score on

[*] Harcourt Assessment, Inc., http://harcourtassessment.com

disinhibition would facilitate adherence to highly restrictive post surgical diets. This seems to be supported with the high CR sample at 6 months post surgery. Although 9 of 15 cases in the high CR profile at 9 months post surgery resulted in the predicted NWL groups, the hypothesis was not statistically supported. There are several possible reasons for these findings. For example, high cognitive restraint may be more facilitative early post surgery and becomes less beneficial with time. Specifically, even though high on cognitive restraint, some individuals may slip back into old eating patterns such as “grazing” or overeating highly caloric foods (e.g., sweets). This type of eating behavior is not at all uncommon in post surgical laparoscopic banding patients. This may be due to the fact that dumping syndrome, common in some types of bariatric surgery, is not present in post laparoscopic banding patients (deZwann, 2005). Further, the patient’s perception of overeating may change over time. For example, the patient’s presurgical concept of overeating more than likely involves very large quantities of food (e.g., binging). This pattern is not possible post surgery without noxious side effects stemming from violating the restrictive nature of the band. After “overeating the band” and experiencing the noxious side effects as many patients do shortly after surgery, most patients quickly learn that the band will not allow them to eat large quantities of food in one sitting. Thus, this behavior is not usually present in the first few weeks after surgery. Therefore, the patient may believe that he or she is protected from overeating. Accordingly, the patient may not perceive grazing, nibbling, or sipping highly caloric sweets (e.g., milk shakes) as overeating because this behavior does not result in unpleasant side effects such as vomiting. Over time these individuals may become less vigilant, if not complacent, about their eating behavior.

It is also possible that the cognitive restraint construct is more complex than was originally posited. A criticism of the restraint score on the EI is that it is too global. Westenhofer (1991) proposed the division of the cognitive restraint scale into 2 subscales, flexible control and rigid control. In a later study, Westenhoefer, Stunkard, & Pudel (1999) validated the dimensions of flexible and rigid cognitive restraint. Rigid control is posited to be the all-or-nothing mindset proposed by Herman and Polivy (1983) in which restrained eaters often eat past the point of satiety after having "blown their diet." Individuals with flexible control, however, purportedly are not predisposed toward rigidity or an all-or-nothing outlook toward dieting. Consequently, they more easily return to their regimen after a slip-up or a temporary relapse. Conceivably, a portion of the sample in this study may have fallen into each of the subscales. Thus, the individuals who fell into the rigid control subcategory may be more prone, especially over time, to the disinhibition effect with or without the accompanying high score on the disinhibition factor. Consequently, these individuals may be more apt to return to prior eating patterns, although these patterns may have been modified to accommodate the physiological restrictions of the gastric band (e.g., grazing).

Most presurgical assessments are not optional as they are required by many bariatric surgeons and are also mandated by most insurance companies that opt to cover bariatric surgery (ASBS, 2003). Thus, it is possible that some high cognitive restraint scores with accompanying low disinhibition scores are the product of social desirability, which is often found with self-report questionnaires. Accordingly, some individuals may have consciously presented themselves in a manner that they believed would be perceived by the evaluator as the most positive. Further, studies have shown that many obese individuals tend to underreport their food intake and over report their physical activity level (Black, Prentice, Goldberg, & Jebb, 1993). This may be because they are not consciously aware of how much food they consume and how little energy they expend or there may be a social desirability factor involved. Such beliefs and mindsets, conscious or unconscious, often influence responses on self-report questionnaires such as the EI.

Hypothesis 1B: Super High Cognitive Restraint Profile (Super High CR)

The hypothesis that individuals with a super high cognitive restraint profile (super high CR) would place in the normal weight loss group (NWL) was supported at both 6 and 9 months post surgery for these samples. It is interesting that the combination of cognitive restraint clinical scores and low disinhibition scores appear to be facilitative in managing highly restrictive post surgical diet regimens at both time intervals, which was not the case in the high CR profile. It is possible that the greater degree of cognitive restraint afforded by scores in the clinical range in comparison with the high range is responsible for the different results found in those profiles at 9 months. It is conceivable that this observation may be accounted for if there are indeed 2 subscales of the cognitive restraint factor which have moderated these results. However, it is also likely that the cognitive restraint factor is highly sensitive and decidedly differentiates the characteristics and eating patterns of high scorers and clinical scorers.

Hypothesis 2A: High Disinhibition Profile (High D)

The hypothesis that individuals with a high disinhibition profile (high D) would place in the low weight loss group (LWL) was not supported at either 6 or 9 months post surgery for this sample. Statistically the model was a good fit. However, the prediction was overwhelmingly in the wrong direction with 23 of 25 individuals placing in the NWL group at 6 months and 21 of 29 individuals placing in the NWL group at 9 months. This is very puzzling in that the profile was comprised of factor combinations that are thought to be strongly associated with the disinhibition effect (i.e., high scores on both cognitive restraint and disinhibition). Also included were combinations in which the disinhibition score was high and the cognitive restraint score was low (see Tables 2 and 3). Intuitively, individuals in this profile seem at risk for the continuance of old eating patterns post surgery. Indeed, this still may have been the case even though the hypothesis was not confirmed.

Powers, Perez, Boyd, & Rosemurgy (1999) reported that in their study 33 - 70% of patients purposely and regularly vomited in order to avoid weight gain 5 years post gastric banding surgery. In another study, it was noted that vomiting often increases as a function of time after surgery (Kinzl, Traweger, Trefalt, & Biebel, 2003). Accordingly, it has been suggested that the modified upper gastrointestinal tract might support a new eating behavior that could be perceived as failed attempts to binge (Powers, Rosemurgy, Coovert, & Boyd, 1988). It is conceivable that a significant number of the individuals in the high D profile were actually at high risk for disinhibition effect, but were able to continue losing weight by purposely vomiting after disinhibiting instances occurred. These results seemingly contradicted the notion that profiles high in both cognitive restraint and disinhibition are at high risk for disinhibition effect. However, if compensatory eating patterns such as purposeful vomiting have mediated the results in this profile, then it would lend support to the rationale behind the hypothesis and the direction in which it was initially predicted (i.e., LWL group). This appears to be an important piece of the gastric banding post surgical weight loss puzzle that warrants further investigation. In retrospect, it may have been useful to have recorded the number and type of post surgical complications documented in the chart in order to explore the possible connection between risk factors for the disinhibition effect (i.e., high CR and high D) and possible behaviors such as purposeful vomiting.

As discussed earlier, some individuals may rely entirely on the protective properties of the gastric band to prevent them for overeating. Thus, they do not recognize that their adaptive eating patterns (grazing) may be sabotaging their weight loss. Conversely, it is reasonable to assume that a number of individuals who perceive the gastric band to be completely protective do not develop alternative eating patterns. Perhaps these individuals have an external locus of control similar to the characteristic measured by the Powerful Others scale on the Health Attribution Test. Individuals who have high scores on the Powerful Others scale are thought to place high trust in professionals and in the medical profession specifically (Achterberg & Lawlis, 1990). Accordingly, such individuals may be highly influenced by manufacturer's advertisements and strongly respond to the surgeon's assurance that they will be successful if they undergo the gastric banding procedure and meticulously follow the post surgical regimen prescribed by the aftercare team. Because this information comes from individuals they perceive as experts (i.e., manufacturers and surgeons), these individuals may have strong confidence that they will succeed. Consequently, they adhere to the post surgical plan more stringently than others who fall within the same EI profile, but do not place an inordinate amount of faith and trust in professionals per se. This concept is similar to Schachter's notion that obese individuals are more susceptible to external or environmental cues than their normal weight counterparts when the environmental cues are "salient and compelling." The prescriptions made by surgeons and the touts of gastric band manufacturers could certainly be considered salient and compelling.

2B: Super High Disinhibition Profile (Super High D)

The hypothesis that individuals with a super high disinhibition profile (super high D) would place in the low weight loss group (LWL) was not supported with this sample at either 6 or 9 month post surgery. These results are also puzzling in that this profile was formulated with disinhibition scores in the clinical range accompanied by cognitive restraint in the low range. This profile also contained formulations in which both cognitive restraint and disinhibition were in the clinical range which indicates high risk for the disinhibition effect (see Tables 2 and 3). Accordingly, these formulations intuitively predict difficulties with highly restrictive post surgical diets. Similar to the findings in the high D profile, the super high D profile was a good statistical fit, but was overwhelmingly predicted in the wrong direction with 23 of 28 individuals placing in the NWL group at 6 months and 20 of 25 individuals placing in the NWL at 9 months.

Very much the same as the high D profile described above, some individuals in the super high D profile may also be engaging in compensatory eating behaviors such as purposeful vomiting which would have allowed them to continue to lose weight despite their propensity toward the disinhibition effect. It is also reasonable to assume that if some of the individuals in the super high D profile have an external locus of control similar to the characteristic measured by the Powerful Others scale on the Health Attribution Test, they too would be inclined to have great faith in the protectiveness of the gastric band against overeating. Further, these individuals would also likely place great stock in the aftercare team's assurances that they will be successful if they meticulously follow the stringent post surgical diet. Thus, the salient and compelling external or environmental cue may somehow override the potentially deleterious clinical score on disinhibition and the potentially deadly combination of clinical ranges on both disinhibition and cognitive restraint which was predicted to be the impetus of the super high D profile.

These puzzling and unexpected results strongly indicate a critical need to formulate and test hypotheses about the consequences of high and clinical scores on the disinhibition factor and what other factors or circumstances mediate and moderate them.

Hypothesis 3A: High Hunger Profile

The hypothesis that individuals with a high hunger (high H) profile would place in the normal weight loss group (NWL) is not supported at either time interval for this sample. This profile was comprised of individuals who scored high on hunger and low on both disinhibition and cognitive restraint (see Tables 2 and 3). Although 8 out of 11 cases were correctly placed in the NWL group, the model was not statistically a good fit and thus, the hypothesis was not supported.

Studies indicate that patients usually experience less hunger after all types of bariatric surgery (e.g., deZwaan, 2005). This was reasoned to be particularly true for laparoscopic banding patients in that the band purportedly diminishes the sensation of hunger by reducing the size of the stomach. This regulates the flow from the upper part of the stomach to the lower part of the stomach thereby increasing the time necessary for the food to get through the digestive system. Thus, it was expected that presurgical hunger in laparoscopic banding patients would be substantially lowered post surgery in individuals whose hunger score was high in comparison to the other factors (cognitive restraint and disinhibition). This did not appear to hold true at either the 6 or the 9 month time intervals.

The unexpected results of the high H profile may be accounted for in several ways. It is well established that post surgical weight loss in laparoscopic banding patients depends largely on the patient's motivation and capacity to make life-long behavioral changes (Favretti, O'Brien, & Dixon, 2002). Although it is established that the laparoscopic banding procedure severely reduces the capacity to eat large quantities of food in a short period of time, some studies have reported that the sensation of hunger is not diminished in these patients (e.g., Karlsson, Sjostrom, & Sullivan, 1998). Further, problematic eating behaviors such as grazing, frequent snacking, and nibbling are not critically affected by the laparoscopic band. Indeed, these problematic behaviors have been identified as the most encountered and the most difficult to manage in post surgical patients (deZwaan, 2005).

A possible explanation for the unexpected results of the high hunger profile could be in the classification of the profile itself. The high hunger profile was comprised of factor scores that were low to average on both cognitive restraint and disinhibition but high on hunger. According to the theory that individuals who score high in both cognitive restraint and disinhibition are subject to the disinhibition effect, it may also be true that in some cases, scoring low in cognitive restraint may offset the effects of the low score on disinhibition. Thus, this profile may have been better classified as a low cognitive restraint profile rather than a high hunger profile. However, to do so in this study would have violated the criteria for the compilation of the profiles, which were formed from the combinations of raw scores that were either high or quite high (high/clinical range) or low (low to average range) in comparison with the other scores from which the profile was derived (see Tables 2 and 3).

It seems intuitive that low scores on disinhibition would be overall facilitative to weight loss when paired with high hunger scores. Accordingly, it is reasonable to think that these individuals would be less susceptible to the disinhibition effect. Interestingly, however, Westenhoefer et al (1994) argued that loss of control can be triggered by overwhelming feelings of hunger that are not necessarily the result of high disinhibition or the combination of high disinhibition and high cognitive restraint thought to produce the disinhibition effect. It is possible that this was the case for the individuals in this study.

Although researchers are exploring intractable hunger in post surgical gastric banding patients, it is not known how long post surgical hunger can be suppressed by the band alone (e.g., Kaiser et al., 2004). The current results suggest that despite the hunger assuaging effects that the gastric band is thought to have on post surgical hunger, this may not hold true in all cases. Nevertheless, 8 out of 11 cases were placed in the NWL as predicted at 6 months, which seems to suggest that testing with another sample may have yielded different results. Thus, further exploration of this phenomenon appears critical.

Hypothesis 3B: Super High Hunger

The hypothesis that individuals who have a super high hunger profile (super high H) would be placed in the LWL group was not supported at either time interval. The super high H profile was essentially the same as the high H profile except that the super high H individuals scored in the clinical range on hunger rather than in the high range. Both profiles had low cognitive restraint and disinhibition scores (see Tables 2 and 3).

It was reasoned that individuals who score in the clinical range on hunger and low in cognitive restraint would be more prone to problem eating behaviors such as those noted above (i.e., grazing, nibbling, and snacking) than their counterparts in the high H profile. This was based simply upon the score being in the clinical rather than the high range. Thus, these individuals were predicted to have more post surgical difficulties with managing hunger. Although the model was not able to be statistically tested in the 6 month sample, it appears that this was not the case as all 5 cases resulted in placement in the NWL contrary to the hypothesis. Similarly, of the 5 individuals with the super high H profile in the 9 month interval, 4 placed in the NWL group which was contrary to the hypothesis.

It is possible that the gastric band was successful in assuaging hunger in this group. It is feasible that individuals who score in the clinical range in hunger are very much more sensitive to the restrictive properties of the band than their high H counterparts. It is also possible, as outlined above, that these individuals have an external locus of control such as that measured by the Powerful Others scale on the Health Attribution Test. If this is so, then these individuals would be more prone to adherence to rigorous aftercare regimens and thus, more likely to be in the NWL group.

Hypothesis 4: Null Profile

The null profile predicted normal weight loss (NWL) and was supported at 6 months post surgery although the model was not able to be tested. At 9 months post surgery, the model was not statistically a good fit although 10 of 13 individuals with this profile were placed in the NWL group. These findings seem to support the thought that individuals with scores in the low range on all three factors (see Tables 2 and 3) are likely not at risk for the disinhibition effect, nor do they report significant problems with being overly hungry. Accordingly, it is expected that these individuals will have fewer problems adapting to the post surgical restrictive diet which appears to be the case at both time intervals, although this was not specifically supported by the results.

It is notable that the weight loss distributions were negatively skewed in all profiles. Consequently, a greater proportion of cases fell within the normal weight loss group. It is possible that the INAMED criterion (i.e., 1 pound per week) is overly generous. This appears purposeful in order to foster encouragement early post surgery which may build confidence that carries over when weight loss plateaus in many individuals at various post surgical stages (INAMED Corporation, 2005). Of course, it is also entirely possible that these observations are anomalous to this particular sample.

General Factor Model

The accuracy of the profile model and the general factors alone (cognitive restraint, disinhibition, and hunger) were compared. In order to make this comparison, scores on cognitive restraint, disinhibition, and hunger were used as predictor variables and were analyzed with the same statistical procedure as the profile model. The percentage of correctly classified cases in the LWL group and the NWL group were calculated. Results indicated that the profile model is an overall better predictor at both 6 and 9 months post surgery than the general factor model. The exception was that the disinhibition single factor produced 53.2% correctly classified cases at 6 months post surgery and 47.7% correctly classified cases at 9 months post surgery; whereas, the profile model (i.e., high D and super high D) produced substantially fewer correctly classified cases at both time intervals (see Tables 15 and 16).

It is interesting that the disinhibition factor produced 47.7% correctly classified cases at 9 months. Although considerably more accurate than the profile model (i.e., high D, and super high D) at either time interval, the general factor model's correctly classified cases at 9 months was slightly less than by chance alone. Thus, the disinhibition factor alone does not appear to do a significantly better job at classifying cases than the profile model at the nine month time interval. This suggests that the profile model may be a viable concept and should be further studied and perfected. These results also seem to suggest that the disinhibition construct is not fully understood and should continue to be researched and refined.

Additional Observations and Analysis

In this sample, the weight loss distribution at both 6 and 9 months was notably negatively skewed with more cases that met or exceeded the INAMED criteria for satisfactory weight loss. It was observed that 83% of the sample met or exceeded INAMED criteria at 6 months (M = 42.38, SD = 18.50) and 73% of the sample met or exceeded INAMED criteria at 9 months (M = 51.37, SD = 20.95). A chi-square goodness-of-fit test revealed that the percentage of cases in the NWL group did not differ by profile at 6 or 9 months post surgery. Thus, the null hypotheses were retained, indicating that the samples came from a distribution in which 83% met or exceeded the requisite weight loss at 6 months post surgery and 73% of the sample met or exceeded the requisite weight loss at 9 months post surgery. These observations seem to question the overall usefulness of profiles and the general factor model with this sample, at least at the 6- and 9-month post surgical time intervals using the INAMED weight loss criteria as outcome. It is also remarkable that the mean weight loss at 6 months in this sample (M = 42.38, SD = 18.50) is considerably higher than the requisite INAMED weight loss criterion for NWL group at 9 months (39 lbs). Fifty-three percent of the sample at 6 months met or exceeded the 9 months criterion for NWL. This seems to suggest that either the INAMED criteria may be overly generous or that weight loss in the first few months post surgery may not be greatly influenced by presurgical eating patterns.

As mentioned earlier, relatively little research has addressed the effects of bariatric surgery on life long eating behavior. Further, most of the research has been exploratory with relatively small samples sizes (Bochhieri, Meana, & Fisher, 2002).

However, it is known that weight loss after bariatric surgery occurs due to reduced caloric intake that is a by-product of the surgery itself. For example, in gastric bypass, weight loss is facilitated by malabsorption and dumping syndrome, whereas in the LAP-BAND® system* procedure, weight loss is facilitated by the restriction created by the gastric band fastened around the upper stomach to create a very small stomach pouch. Negative feedback in the form of vomiting occurs when too much or the wrong kind of food is ingested. Accordingly, most patients do not have much interest in food immediately post surgery and are focused on eating the right things (deZwaan, 2005). However, maladaptive eating patterns have been shown to recur two years or more after restrictive surgeries. These patterns are thought to be related to finding alternative ways of overeating such as grazing and drinking highly caloric liquid food while avoiding noxious feedback such as vomiting (Hsu et al., 1998). Other researchers have found that a substantial percentage of patients who reported presurgical binge eating reported recurrences of overeating in the form of grazing and frequent snacking after 12 months to 2 years post gastric banding. The delay in the return of maladaptive eating behavior has been posited to be moderated by the end of the honeymoon phase. The honeymoon phase is the initial post surgical period in which most individuals receive abundant positive social feedback as a result of their rapid weight loss. This is a time when health issues begin to improve and individuals typically feel hopeful about the future (deZwaan, 2005). However, after a year to 18 months, a plateau is usually reached where weight loss is drastically slowed or temporarily stopped. At this time the positive feedback may not be as strong or as reinforcing as it was during the initial rapid weight loss period. Thus, researchers have hypothesized that eating-related attitudes

* Allergan, Inc., http://www.lapband.com/lapband/portal.do

may begin to erode and many individuals revert back to old eating patterns (e.g., Bocchieri et al., 2002; deZwaan, 2005). If this is true, it is highly possible that presurgical eating patterns and profiles may indeed predict post surgical weight loss, albeit perhaps much later than the 6- and 9-month time intervals measured in this study. Conversely, old eating habits may actually begin to resurface at around 6 months post surgery. Grazing and recurrent feelings of loss of control of eating have been reported in some studies at around 6 months post surgery (e.g., Saunders, 2004). Eighty-three percent (83%) of the sample in this study met or exceeded NWL criteria at 6 months post surgery, but the percentage was reduced to 73% at 9 months. It seems feasible that the return of maladaptive eating behaviors could have been a factor in the decline in percentage between 6- and 9-months post surgical time intervals. However, this is purely speculative in that data was not collected beyond 9 months post surgery and there is no way to determine if the decline was the beginning of a trend. Accordingly, it appears worthwhile to re-test the hypotheses offered in this study for their predictability at several intervals beyond 9 months.

Conclusions

The purpose of the study was to investigate the efficacy of profiles, comprised of the three factors on the EI*,* to predict weight loss in post surgical laparoscopic banding patients. Few studies have found consistent relationships between presurgical factor scores and subsequent weight loss. Further, there is a notable absence of studies utilizing the EI to predict outcomes in bariatric surgical patients. Given that many measures (e.g., the Health Attribution Test*)* are considered to be diagnostically more useful when subscale scores are interpreted as a whole (i.e., in a profile) than when they are considered independently, it is important to explore whether the EI yields useful profiles as well. Thus, this was the premise of the study.

Many areas of potential clinical utility were revealed in this study. For example, the high cognitive restraint profile and the super high cognitive restraint profile appear to successfully predict post surgical weight loss at least within the first nine months post surgery. The first year is thought to be a critical time when individuals are likely to experience difficulty in adapting to new and stringent eating behaviors that are necessary for post surgical success. Although the individuals in this study overwhelmingly met or exceeded the criteria for satisfactory weight loss at both the 6 and 9 months time intervals, it is not known whether they experienced difficulties or developed any type of compensatory eating patterns (e.g., purposeful vomiting). Clearly, additional data of this nature would be useful in subsequent studies.

Also of interest is the finding that the profile model (with the exception of the high D and the super high D profiles) more accurately predicted post surgical weight loss than did the general factor model. This lends support to the notion that future research in this area (i.e., development and testing of profiles) is warranted.

Although the high D and the super high D hypotheses were not supported, an important question was raised. Are individuals who score high on both cognitive restraint and disinhibition automatically at risk for the disinhibition effect, which is thought to negatively affect post surgical success? Or are there certain circumstances and moderating factors that may neutralize this phenomenon? The questions, spawned by this study, create a premise for new avenues to explore regarding the disinhibition construct and how it relates to successful weight loss in post surgical laparoscopic banding patients.

The fact that an overwhelming majority of the individuals in this sample met or exceeded the criteria for normal weight loss at both the 6 and 9 months time intervals reinforces the need for longer monitoring period. If indeed, many individuals do begin to revert to presurgical eating patterns after the first year, then it is logical to retest the hypotheses to include longer time frames.

Although the viability of the profile model was not clearly established, the overall results of this study significantly contribute to the existing literature of presurgical psychological assessment of the bariatric surgical population. For example, this research provides a base from which other researchers may formulate hypotheses and conduct studies regarding profiles that may be inherent, but not yet explored, in the EI as well as in other assessment instruments with the ultimate goal of designing and implementing appropriate and useful pre and post surgical interventions for laparoscopic banding patients.

Weaknesses of the Study and Suggestions for Future Studies

There are several weaknesses of this study that may have moderated the results. The number of cases in this study was relatively small (*N*=109) in each data set (i.e., 6 and 9 months post surgery). Although the power was adequate, a larger *N* would be highly desirable so that more profiles could be explored. Further, a higher *N* would make it more feasible that every profile explored would be statistically testable, which was not the case in this study.

The study was comprised of mostly Caucasian women (83.6% and 82% respectively). Future studies should include a more balanced population in both gender and ethnicity. Perhaps one of the most limiting factors was the relatively short post surgical time intervals for which weight loss data was collected. The first year after bariatric surgery is considered critical. However, maladaptive eating patterns have shown to recur well after the first year. Thus, future studies should include data at 12 months post surgery and beyond.

It would also be useful to explore the utility of profiles using percent of excess weight loss (% EWL) as the outcome variable rather than absolute pounds lost. This measure may be more equitable in that some individuals have more or pounds in excess weight than others. Individuals with more excess weight lose absolute pounds quicker than those with less excess weight. However, individuals with more initial excess weight lose the least percentage of their excess weight in the first few months post surgery than those who have fewer pounds of initial excess weight (Cowan, Hiler, & Martin, 2004).

Certainly there were weaknesses and shortcomings. However, as stated earlier, this research significantly contributes to the existing literature. More importantly, it provides the basis for additional studies in an area not yet explored with the ultimate goal of designing and implementing efficacious pre and post surgical interventions for laparoscopic banding patients.

APPENDIX

REGRESSION RESULTS

Table A-1

Direct Logistic Regression Results Profile Model 6 Months Post Surgery

Profile	*B*	*SE*	Wald	*df*	Sig.	C-S R^2	Ngk R^2	HL	%> chance
High CR	1.386	.645	4.918	1	.027	.281	.487	.583	34.6
Super H CR	1.386	.645	4.612	1	.032	.060	.096	.439	30.0
High D	1.526	.493	9.565	1	.002	.026	.042	.643	32.1
Super H D	1.386	.500	7.687	1	.006	.187	.296	.212	30.0
High H	.981	.677	2.099	1	.147	.165	.240	.236	31.8
Super H H*	*n/a	*n/a	*n/a	*n/a	*n/a	*n/a	*n/a	*n/a	*n/a
Null*	*n/a	*n/a	*n/a	*n/a	*n/a	*n/a	*n/a	*n/a	*n/a

Note: *Model could not be tested; C-S = Cox-Snell; Ngk = Nagelkerke; HL = Hosmer-Lemmeshow.

Table A-2

Direct Logistic Regression Results Profile Model 9 Months Post Surgery

Profile	*B*	*SE*	Wald	*df*	Sig.	C-S R^2	Ngk R^2	HL	%> chance
High CR	0.405	0.527	0.592	1	.442	.013	0.018	0.162	10.0
Super H CR	2.303	1.049	4.820	1	.028	.013	0.029	0.248	40.9
High D	0.965	0.413	5.396	1	.020	.217	0.314	0.538	32.8
Super H D	1.386	0.500	7.687	1	.006	.112	0.177	0.448	30.0
High H	.182	0.606	0.091	1	.763	.074	1.000	0.389	13.6
Super H H*	1.386	1.118	1.537	1	.215	.632	1.000	1.00	50.0
Null*	1.204	0.658	3.345	1	.067	.480	0.727	0.783	34.6

Note: C-S = Cox-Snell; Ngk = Nagelkerke; HL = Hosmer-Lemmeshow.

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